FLIGHT, MARCH 14, 1935

FIRST AERO WEEKLY IN THE WORLD

REGD. AT THE G.P.O. AS A NEWSPAP

FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

No. 1368
Vol. XXVII

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

SIXPENCE
EVERY THURSDAY

FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

Founded in 1909

FIRST AERONAUTICAL WEEKLY IN THE WORLD

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King's Cup Reflections

IN 1922 the whole British aeronautical business was in a very depressed state, and when His Majesty the King first presented a cup for a race which should stimulate interest in flying the beneficial result was apparent at once. Thirteen years have passed since then, conditions have changed, and it now seems desirable that the Royal Aero Club should bethink itself and set forth clearly what purpose it considers that the King's Cup Race ought to serve. There are various possible objects. The race may be used as a stimulus to manufacturers to improve the breed of aeroplanes; it may be held out as the Blue Riband of the air to flying clubs and private owners; and again it may aim at the goal of spreading airmindedness by trying to attract the public to aerodromes. The object of the race will be made clear by the way in which the regulations are framed.

As regards the third possibility, namely, attracting the public to aerodromes, this object is worth while, provided that the race is held in the North and the Midlands; but so far as London is concerned it should be absolutely disregarded. This conclusion is based on the history of the past races. The people of London have shown twelve times that they will not go even to such an accessible aerodrome as Hendon to see the start or finish of an air race. It follows that if the Royal Aero Club will not select a city such as Manchester for the start and finish, then it should not waste energy and spoil the other aspects of the race by trying to produce a close finish at a London aerodrome. Even if the race is moved northwards, it is still a mistake to sacrifice its possible usefulness to the staging of a popular spectacle. The race to Australia offered no spectacle, but it aroused world-wide interest, and it produced at least one very remarkable new design.

There is no solid justification for using the King's Cup as a prize for private owners. There are quite a number of races already devoted to their interests, including the Grosvenor Cup, the Siddeley Trophy, the S.B.A.C. Cup, and at least five other annual races. The best service which the King's Cup Race can now do to British aeronautics is to encourage improvement in aircraft design. This implies the careful framing of a judicious formula for handicapping, which would leave it to designers to get the best results out of a known set of conditions. It would probably not produce a close finish, but it would lend quite a new and valuable interest to the race. Incidentally, the prospect of seeing novel aircraft, possibly with some startling performance, would be quite likely to attract crowds of northerners to the aerodromes, though the London crowd might remain as indifferent as ever.

An Ill-matched Pair

The Royal Aero Club, in the regulations published for this year's race, has fallen among several stools. It has decided on a race round the British Isles, which is quite a good thing. It has tried to attract entries of both fast machines and lower-powered machines, catering apparently for the private owner and for the aircraft firm at the same time. Class racing is in itself an improvement on the old plan of admitting all comers and handicapping the whole field on estimated performance. That bad old plan, however, has cropped up again in the final heat on the second day, when fast and comparatively slow machines will all be handicapped on estimated speed with the futile idea of making a spectacle for Londoners. The clinging to this outworn idea has vitiated whatever merits the first day's racing displays. In fact, the contests of the first and the second day make a very ill-matched pair.

The Racing Committee of the Royal Aero Club has, however, shown signs of grace by promising to produce a handicapping formula for future years. It must be admitted that the formula could not have been applied to this year's race, but it should be published and thrown open for discussion at the earliest possible date. With a formula in operation it will be clear that the King's Cup is to be a contest for designers.

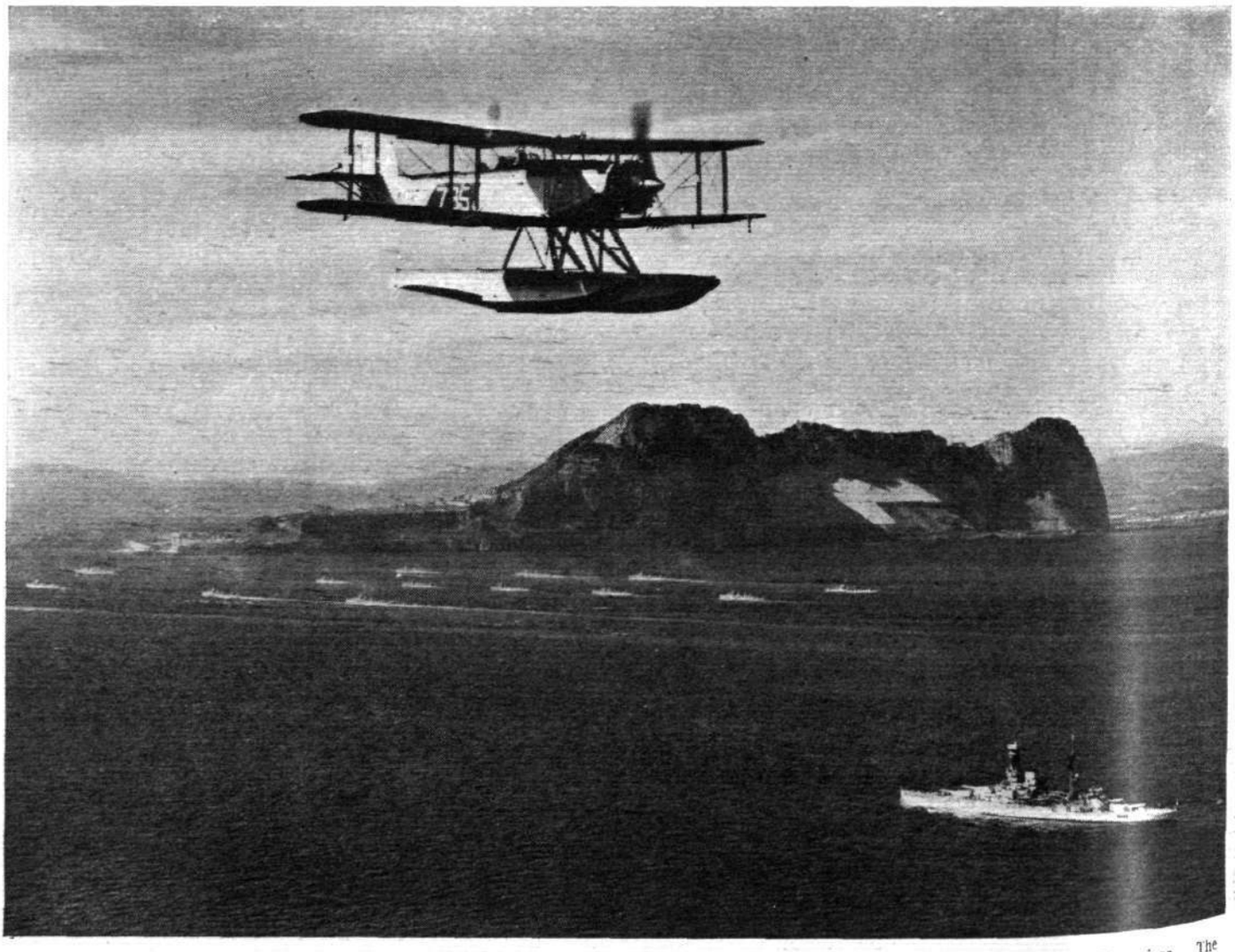
Cheating the "Cube Law"

IT is an old saying that rules and laws are made to be broken. A fundamental law in aircraft construction is that if one builds a "scaled-up" version of a given aircraft the area will increase as the square, but the bulk—or, in other words, the weight—will increase as the cube. This is strictly true for geometrically similar machines, and for a good many years the law was quoted as an argument against the really large aircraft. That the "cube law," as it is generally called, can be "cheated" has been known for a long time, but designers differ in their views of the length to which the cheating may be carried. Refinements which are impracticable in the smaller aircraft become possible in a larger type, and the stresses do not necessarily increase in proportion to size in all component parts of the machine.

Mr. A. Gouge, in a paper of which extracts are published in *Flight* this week, proves himself an adept at "cheating the cube law." He visualises the possibility of building flying-boats of 300,000 lb. gross weight, in which the ratio of gross weight to tare weight is kept as high as 1.65. A flying-boat which carries as disposable load 65 per cent. of its own weight is regarded as quite good at the present time, and in much more modest sizes. Recently the Americans have claimed a much higher ratio, but one is far from being convinced that American designers are so much more clever than British, and the American figures must either be somewhat optimistic, or else the Americans are going to much lighter scantlings than we are prepared to accept in British flying-boats.

Reference was made in *Flight* recently to the fact that our commercial flying-boats have been developed largely from the experience available with military flying-boats. The policy dictated by military considerations has been in the direction of an aircraft capable of operating in far from favourable conditions of wind, sea, and tide, and it may be that we are erring a little on the side of robustness. Such, however, has been our policy. One famous firm of flying-boat constructors summed up its policy, some years ago, in the slogan "a boat that will fly rather than an aeroplane that will float."

The fact that Mr. Gouge not only believes the large flying-boat possible, but that he estimates its efficiency to be as high as that of smaller boats of the present time, promises well indeed for the future. There are, as far as we can see, but two weak points in Mr. Gouge's armour, both of which he frankly admits in his paper: The size of available power units and the high wing-loading used to keep structure weight down. Mr. Gouge foresees the possibility of grouping four engines into a single unit, as was done by Louis Breguet several years ago, although not with marked success. A wing loading of 40 lb. per square foot of wing area is "Schneider loading," but may be permissible in a very large aircraft.



ON THEIR LAWFUL OCCASIONS. A magnificent impression of a scene at Gibraltar during the Combined Exercises. The seaplane is a Fairey "Seal" (535 h.p. "Panther IIa") of the Fleet Air Arm. The rain-water catchment slope on the face of the Rock is clearly visible.

The Outlook

A Running Commentary on Air Topics

Making It Difficult

EVER since Mr. Baldwin was so injudicious as to say, "The bomber always gets through," he has been trying to explain away his words. In the Defence debate in the House last Monday he arrived at a much more satisfactory and sensible statement. "It is quite true," said he, "that you cannot ensure immunity against air attack, but you can make it more and more difficult. That was the idea of a proposed air pact—to make it more difficult. There comes a point when attack is not worth while." Both tactically, regarding the use of air defence measures, and politically, regarding the proposed pact with France, Belgium and Germany, these words are wise and true. Everyone should now forget the earlier saying.

As regards the increase in the Air Force, Mr. Baldwin reiterated his policy of seeking equality, not with the largest foreign air force, but with that of any Power which may be within striking distance. That has been said many times, but it was desirable to say it again.

The only other point in the debate which was of importance from the air point of view was Sir John Simon's explanation that the difficulty of carrying at Geneva the abolition of air forces was the great problem of civil flying. He said that it was high time that everyone realised what the difficulty was. As for the absurd suggestion that civil aircraft should be internationalised or put under international control, Sir John prudently left that point severely alone. There was nothing new in what he said, but it is desirable that the facts should be repeated until they are generally accepted.

Alternative Airports

THE need for at least two aerodromes which can be used when Croydon is impossible, which are outside the controlled zone and which are connected by good surface services with the centre of London, has always been a pressing one.

As such aerodromes would be used only when conditions at Croydon were difficult and when the alternatives themselves were liable to be little better off, it is obvious that they should be most fully equipped. Not only should they be prepared for night landings, but they should also be equipped with D/F radio stations and short-range transmission so that they could take up and complete the guidance of incoming aircraft. Poorly equipped alternatives would be worse than useless in the very circumstances in which they might be most sorely needed.

Croydon, because of its comparatively small area and because of the degree of building obstruction in the vicinity, can never be an airport at which radio-guided "zero visibility" landings may be made with real safety, though the latest German system appears to be accurate enough if one approach direction can be kept sufficiently clear. Traffic noise on Purley Way as always, disregarding other considerations, ruled out the possibility of using the "ZZ" system, which depends for its success on the good hearing of a control officer. All blind landings, therefore, would logically be carried out at the alternative airports.

Two Examples

REMEMBERING Mr. Winston Churchill's dictum that "civil aviation must fly by itself," it is, perhaps, a good thing that the two most useful alternatives for the Continental services, Gatwick and Gravesend, are being largely developed by private enterprise. Two companies are to use Gravesend seriously as an alternative this year, and night lighting is being experimented with. Gatwick will, before midsummer, be ready for operators in earnest, and the Southern Railway will bring it as near, in travelling time, as Croydon is to London's centre.

But is it fair that this same private enterprise should be expected to equip these two aerodromes as thoroughly as they should be equipped? And for how long must they wait before being allowed to use short-range radio? Direction-finding equipment is as necessary to an alternative as to a terminal airport—unless, of course, such aerodromes could have automatic radio beacons and/or blind landing equipment; in which case all commercial machines would need to be fitted with complementary instruments.

In Sole Charge

THE question of what does and does not constitute solo flying within the meaning of the act becomes a little difficult after a private or other pilot has exceeded a reasonable number of hours. Obviously, "advanced dual," taken when one has already been flying for a number of years, is as useful as, or even more useful than, solo flying, but the Air Ministry expressly states that the pilot must be in sole charge of the aircraft.

On the other hand, the business of "taking over," either while the chief pilot has a little nap, or for the sake of experience, cannot by any stretch of the imagination be considered as solo flying, however much one may wish to pile up an impressive figure in one's logbook.

At the moment, there is no form of supervision for logbook entries, and there may be odd persons here and there who, without necessarily intending to be dishonest, are making incorrect entries. This is a matter of small import in the case of a normal private pilot, but is liable to be rather more serious when the case of the embryo "B" pilot is considered. Of course, he will have to face severe tests before he finally obtains his commercial ticket, but extended and real experience was, nevertheless, the one reason for making a hundred hours of solo flying the minimum for all pilots about to fly for hire or reward.

Meanwhile, the Air Ministry might again define clearly its conception of solo flying, so that scrupulously honest people may know exactly what may or may not be written in the "pilot" column of the little green book.

Aircraft Control

IT is not an exaggeration to say that the whole future of commercial aviation lies in the successful control of aircraft under those conditions in which the pilot can see nothing at all. Control falls into two categories: that from the ground and that in the air. Both are, in some measure, dealt with in this issue of *Flight*. The former necessitates a control officer having knowledge of the position and action of every aircraft, in the area under his control, at any one minute. This is achieved by radio. A long review, on pages 274-279, discusses the chief points of interest in the latest forms of aircraft radio.

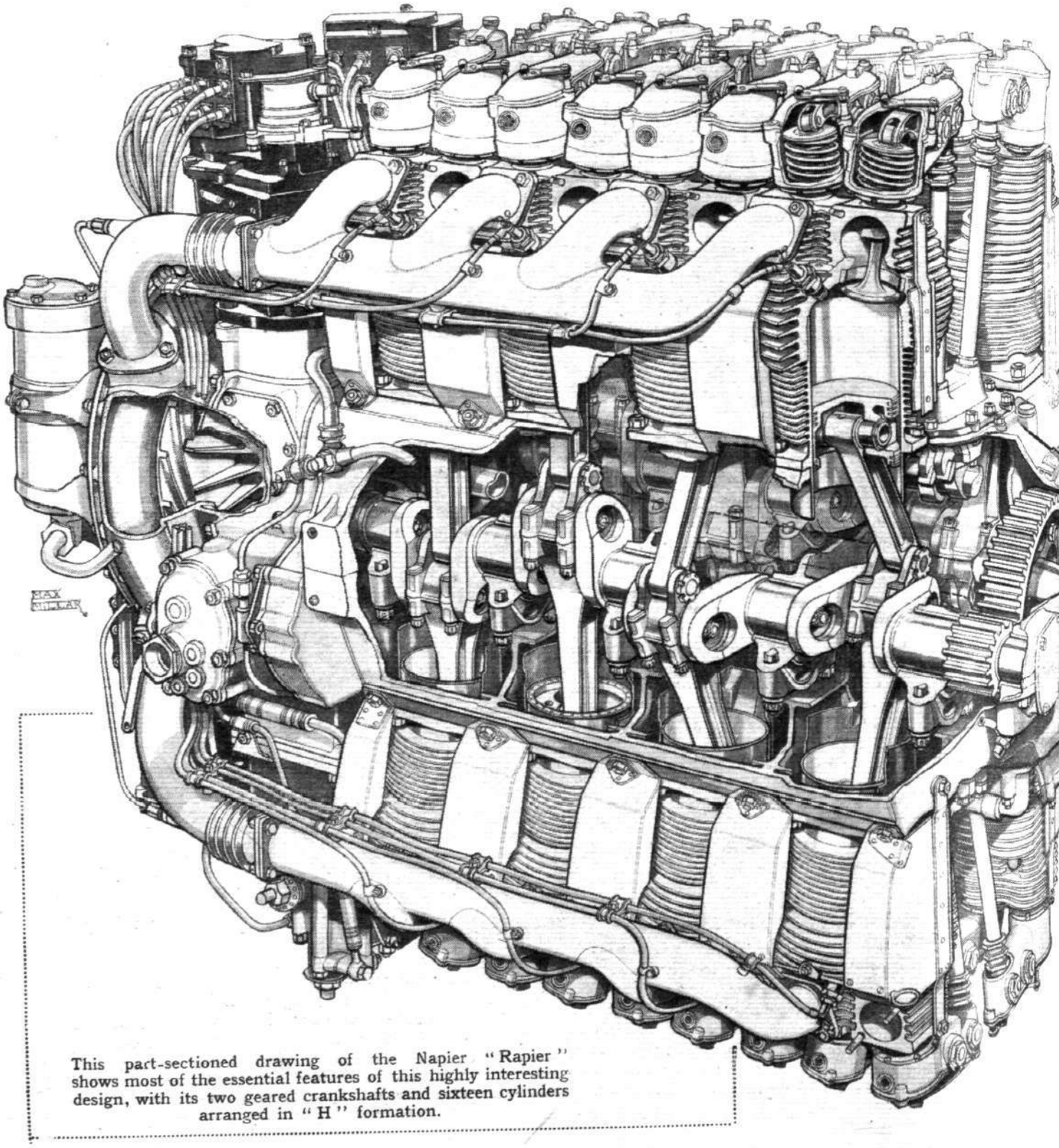
The latter—that is, control in the air—involves the provision of instruments which will enable the pilot to fly although he cannot see the ground. Alternatively, the pilot may be relieved of control altogether by an instrument, the "automatic pilot," and the latest example of such a device is dealt with in our second article. Control by an automatic pilot is more accurate than human control, and relieves the pilot so that he has more time for navigation, a matter of great importance when weather is bad.

THE NAPIER "RAPIER"

A Famous "H-"type Engine Described in Detail : Nearly 100 h.p. per per litre : 1.85 lb. per h.p. : Airscrew Efficiency Kept

EARLY aero engines ran at speeds which were extraordinarily low compared with those of modern motor car engines, i.e., at some 1,300-1,400 r.p.m. Even the modern aero engine runs fairly slowly, few exceeding 3,000 r.p.m. This is partly due to a desire to keep the airscrew speed low in the interests of efficiency, but also to the high stresses set up when large reciprocating parts are run at high speed. The latter consideration predominates in modern engines which employ airscrew reduction gears. In the early days designers fought shy of such gears, but modern knowledge and improved materials have made them possible, and they are now, of course, used on a very large number of engine types.

There are other reasons for keeping engine size down to a minimum. Weight is all-important in aircraft work, and the smaller the engine can be kept for a given power output the better. Drag is another important factor, and it is obviously desirable to keep the frontal area as small as practicable. As power is, within limits, dependent upon engine speed, the natural way to get more power out of an engine of given size is to run it at greater speed; but unless individual parts are small, the difficulties in the way



This part-sectioned drawing of the Napier "Rapier" shows most of the essential features of this highly interesting design, with its two geared crankshafts and sixteen cylinders arranged in "H" formation.

ILY

Frontal Area : 44 h.p.

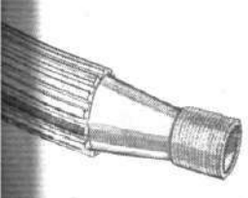
Gearing

of higher speed are serious. An increase in the number of cylinders appears to be the most promising line of approach to the problem.

When Major Frank B. Halford set to work, some years ago, to design a new air-cooled aero engine of fairly high power, he kept these problems well in mind, and the result was the "H" type of engine. As most of our readers will probably know, D. Napier and Son, Ltd., took up the designs and did the development work, and two distinct models of the Napier-Halford "H" engine have by now gone into general use under the name "Rapier," one being known as the Series II, and the other as the Series IV. Others are now coming along which will incorporate certain important modifications in detail, and will take full advantage of the new fuels of higher octane number which have been introduced since the earlier "Rapier" models were produced. The following notes and illustrations deal with the Series II and IV

Generally speaking, the "Rapier II" and "Rapier IV" differ only in the speed of the impeller of the supercharger, that of the Series II running at much greater speed, this engine being designed for, and rated at, an altitude of 10,000 ft., while the Series IV is rated at sea level.

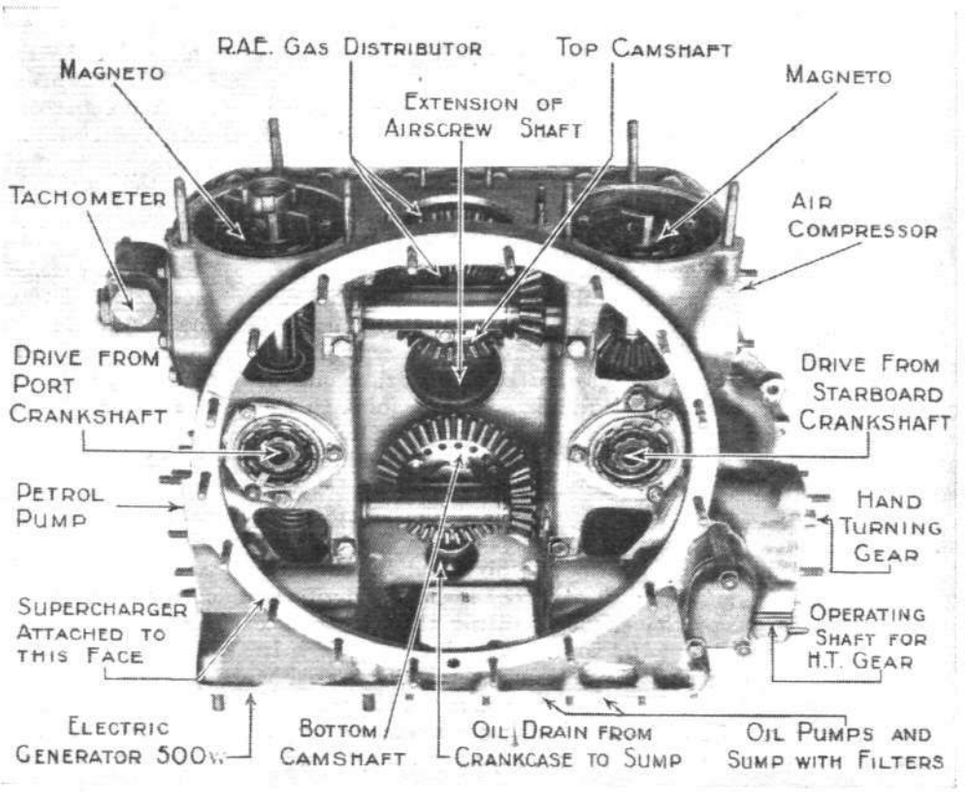
Most of the essential details are shown in the sectioned drawing opposite. Fundamentally, the "Rapier" is a sixteen-cylinder engine in which the cylinders are arranged in four banks of four each, two above the crank case and two below. The crank case is split horizontally, and on each side there is a crankshaft driven by one upper and one lower bank of cylinders. Between the two crankshafts, and driven by them via gears on their front ends, lies the airscrew shaft.



For the airscrew shaft to be driven by both crankshafts it is, of course, necessary for the latter to rotate in the same direction, i.e., in the opposite direction to the airscrew shaft. The gearing being necessary in any case, the opportunity has been taken to introduce reduction of airscrew speed by making the gear on the airscrew shaft larger than those on the crankshafts. The actual ratio is 1 to 2.5625, so that, at the normal speed of the engine, the airscrew is running at 1,366 r.p.m.

As the cranks of the two crankshafts are meshed at 180 deg., firing on the two sides of the engine is "in phase," and the large reduction gear receives an impulse from each pinion simultaneously. This arrangement gives considerable advantages as regards balance and torsional vibration. An additional advantage is that the airscrew shaft is relieved of any bending loads except those due to the airscrew itself, and is in pure torsion. Each crankshaft provides regular eight-cylinder torque to its pinion, and the pair is so arranged that perfect balance is obtained.

The cylinders are steel forgings, machined all over, with screwed-on aluminium alloy heads. Special attention has been devoted to the finning and the question of heat dissipation. The pistons are of forged alloy (D.T.D.58), and



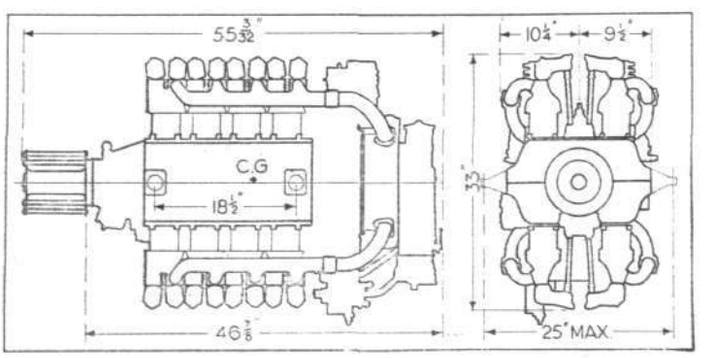
Chief features of the timing gear case, which is interposed between the back of the engine and the supercharger.

are fitted with fully floating gudgeon pins, which are pressure-lubricated from oilways drilled in the connecting-rods. In general, all reciprocating parts are very light, and permit high speeds without undue inertia loadings.

Opposing cylinders share one crank-pin, the connecting-rods being so arranged that the master rods are coupled

"RAPIER" II and IV

Type	16 cyl. "H" air-cooled
Airscrew rotation	L.H. tractor
Airscrew reduction	2.5625 to 1
Bore	3.5in. (*89 mm*)
Stroke	3.5in. (*89 mm*)
Capacity	539 cu. in. (*8 833 c.c.*)
Compression ratio	6.0 : 1
Weight	720 lb. (*327 kg*)
Fuel	D.T.D. 224
Fuel consumption	0.653pt. (0.37 l.) h.p. hr. (Series II) 0.640pt. (0.36 l.) h.p. hr. (Series IV) at full load and International r.p.m.
Oil consumption	8–12pt. (4.54 l.—6.82 l.) per hour.
Normal power	295–305 b.h.p. at 3,500 r.p.m. at 10,000ft. (Series II) 325–340 b.h.p. at 3,500 r.p.m. at sea level (Series IV)
Max. power	340–355 b.h.p. at 3,900 r.p.m. at 10,000ft. (Series II) 370–385 b.h.p. at 3,900 r.p.m. at sea level (Series IV)
Length o.a.	4ft. 7.25in. (*1 403 mm*)
Width o.a.	1ft. 8.75in. (*527 mm*)
Height o.a.	2ft. 11.25in. (*896 mm*)



Installation diagram, giving main dimensions Note the small size of the engine.

to the top port and bottom starboard pistons. The big-ends have separate steel bearing shells lined with lead-bronze.

While the crankshafts are placed one on each side of the airscrew shaft, the two camshafts are placed one above and one below the airscrew shaft, each operating the valves of its adjacent cylinders through the medium of tappet fingers, tappets, and push-rods. The latter are hollow, and operate within outer anchor tubes, which form part of the somewhat unusual valve gear arrangement.

The rocker gear is totally enclosed. The fulcrum bearing loads are transmitted through twin roller bearings to a forged rocker box which is spherically mounted to the valve guide in the cylinder head, while the other end of the rocker box is anchored through a hinged joint to the end of the anchor tube, the lower extremity of which is attached to the crank case. In this way the valve gear loads are shared between the cylinder head and crank case, instead of being concentrated on the former member, as is more usually the case.

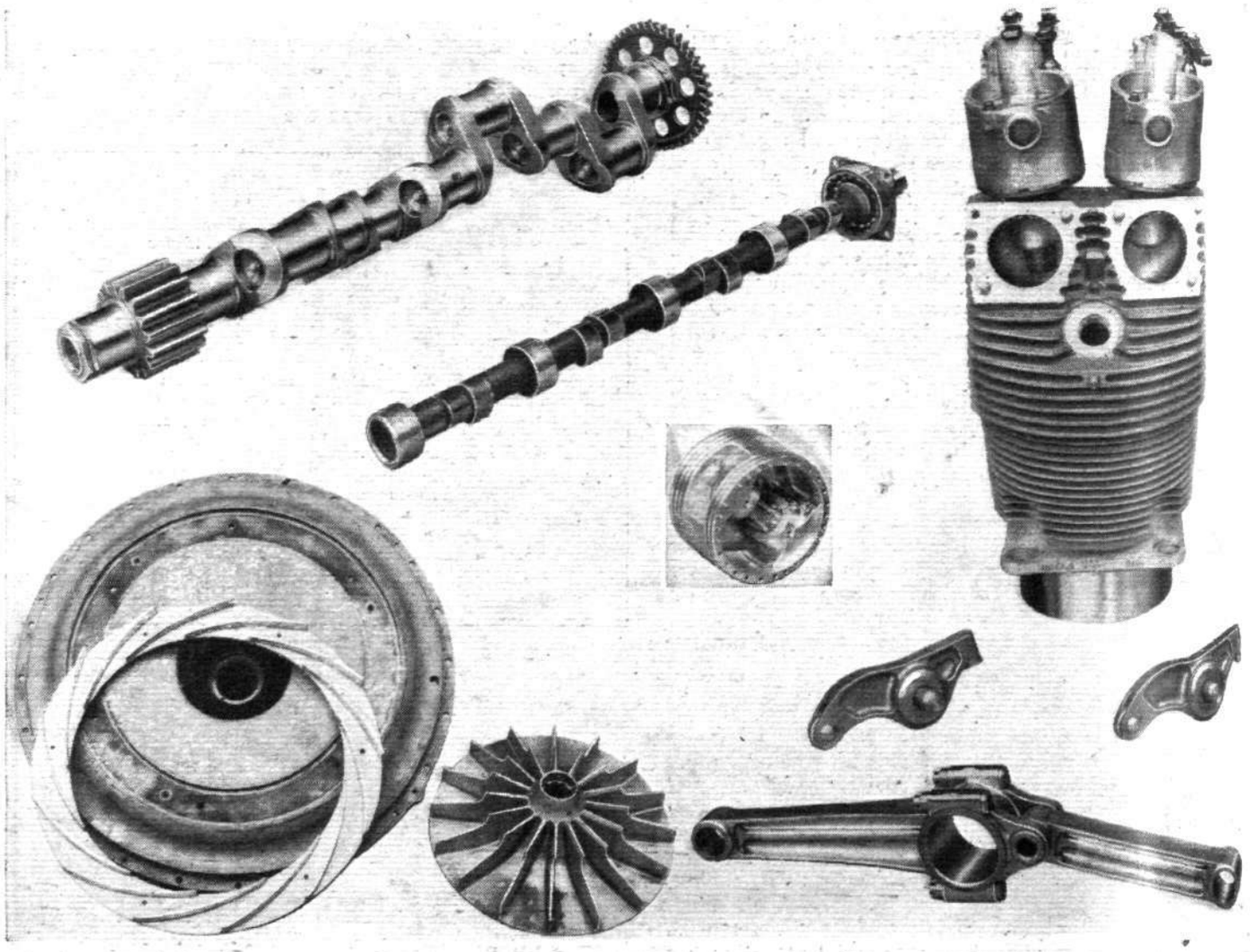
Adjustment for valve clearance is obtained by rotating a right- and left-hand nut on the rocker box end of the outer tube. This has the effect of tilting the rocker box on its spherical mounting and so raising or lowering slightly the valve rocker fulcrum. Moreover, as the outer anchor tube is maintained at a more or less constant temperature, a certain amount of rocker-box tilting occurs as the cylinder assembly expands, and the valve gear is thus, to some extent, self-compensating.

There are two overhead valves per cylinder, seating on stellite-faced inserts shrunk into the cylinder heads. The valve stems are of large diameter to provide ample wearing surfaces and good heat dissipation, but they are made hollow for the sake of lightness. Dual ignition is provided by two independent eight-cylinder Watford SP8.8-3 dual-spark magnetos mounted vertically behind the rear cylinders and running at engine speed. K.L.G. V.8 plugs are used.

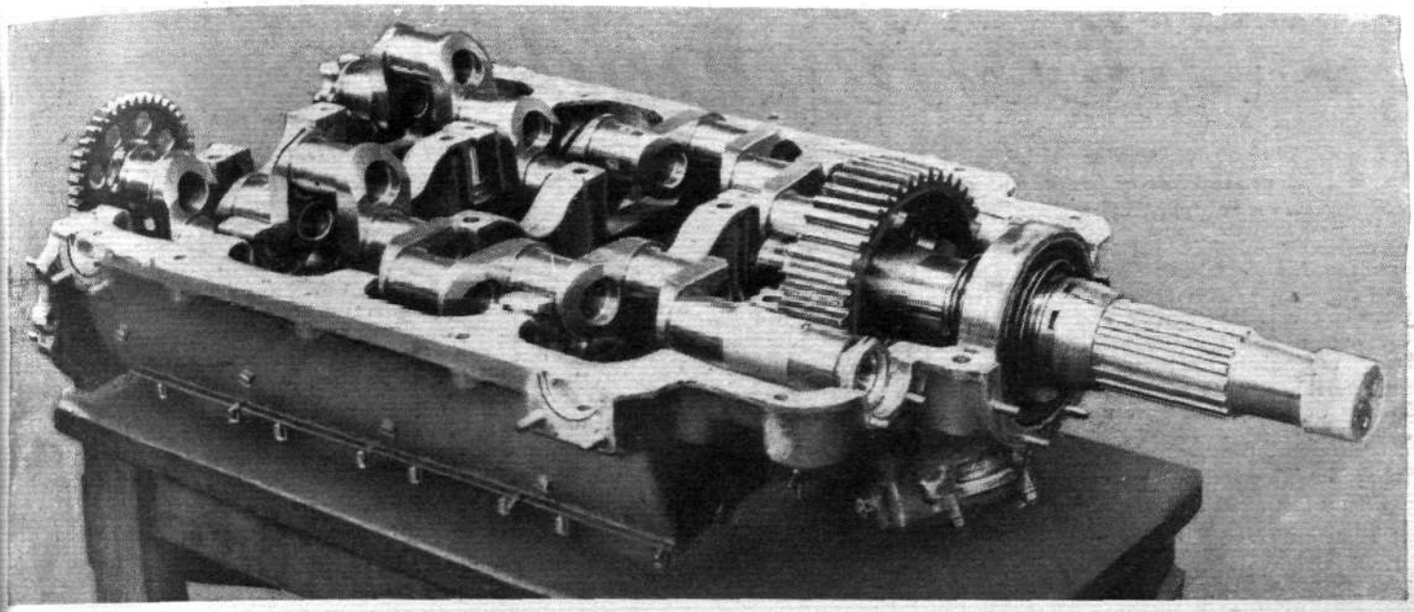
A long tubular shaft passing through the centre of the engine transmits a drive from the airscrew shaft to the increasing gears of the supercharger. Alternative ratios provide for engines having rated altitudes at sea level, 4,000 ft. and 10,000 ft. respectively. The flexibility of the shaft and the steady drive so obtained make any further "cushioning" devices unnecessary. The impeller of the centrifugal blower draws mixture from a vertical Claudel-Hobson AV89a carburetter, and delivers through stationary diffuser vanes into an annular space connecting with the four induction manifolds.

Hand-turning gear is provided for starting, the gear ratio being 8.3 to 1 in relation to the crankshaft. In addition, a gas distributor, situated on the timing gear between the two magnetos, provides an alternative method—compressed air—of starting the engine. Pipes from the distributor convey the compressed air to non-return valves placed in appropriate cylinder heads.

In the lubricating system all the oil used in the engine passes first through a felt pressure filter which is intended primarily as a protection for the lead-bronze crankshaft bearings. Oil is used at two pressures—a high pressure at 50 lb./sq. in. being used for the crankshaft bearings and the main reduction gear jets, while a low-pressure supply at 6 lb./sq. in. feeds all auxiliary drives, camshafts, etc. Return oil, draining from each end of the crank case, is



Some components of the "Rapier"—crankshaft and camshaft, supercharger impeller and diffuser, piston, cylinder, valve rockers and connecting-rod assembly, the last-named comprising one master rod and one auxiliary rod.



One half of the crank case, with crankshafts and airscrew shaft. The main bearings are of the plain lead-bronze type.

returned to the tank by two gear-type scavenge pumps.

It might be expected that cooling of an engine of this layout would present difficulties. Actually, to quote an example, the "Rapier IV" has been found to cool quite satisfactorily in a flying boat with a top speed of about 120 m.p.h. Baffles direct the cooling draught round the backs of the cylinders. Cooling air from a chute is collected between adjacent blocks of cylinders and escapes through the fins to the outsides of the banks, whence it is led away through a suitable slot in the cowling.

A logical development of the "Rapier," once the "H" arrangement of the cylinders had been proved, was a 24-cylinder engine of generally similar design. Such an engine has now been produced, and is known as the Napier "Dagger," of 760 h.p. A batch of these has recently been ordered for the equipment of a R.A.F. squadron.

KING'S CUP REGULATIONS

A "Go As You Please" Eliminating Test : New Territory to be Covered

REGULATIONS for this year's King's Cup Race, which takes place on Friday and Saturday, September 6 and 7, starting and finishing at Hatfield, have now been issued by the Royal Aero Club. The selection of this comparatively late date in the year is partly to avoid clashing with the Jubilee celebrations and partly because, in the late summer, weather conditions are usually most favourable over the northerly and most difficult section of the eliminating course.

The object of this year's race is to provide a combined test of the skill and navigating qualities of the competing pilots and of the speed and reliability of the aircraft, while at the same time ensuring that the final shall be as representative as possible.

The eliminating contest on the first day will be in the nature of a "go as you please trial," the only requirements being that the pilots shall land and check in at each of the official control points, of which there will be four, and turn at each of the official turning points.

For the purpose of the eliminating contest competing machines will be divided into two classes:—

(*a*) aircraft the total engine power of which does not exceed 150 b.h.p. at the maximum permissible revolutions per minute of the engine(s);

(*b*) aircraft exceeding this power.

For the purposes of this classification the power at maximum permissible r.p.m. of the type engine, as established in the engine type test, will be taken.

The course for the eliminating contest will cover a good deal of territory within the British Isles not previously included in any King's Cup Race, and the supplementary regulations for controls and turning points will be designed to ensure that spectators will get a good view of the competing aircraft.

Spectators of the final will see the twenty aircraft which have made the best time in the two classes during the eliminating contest racing over a short-lap course and crossing and re-crossing the aerodrome at frequent intervals.

The principal award is, of course, the King's Cup. Viscount Wakefield has donated £1,000 for prize money, and there is, as usual, the Siddeley Trophy for the best performance by a machine entered by a club.

The first day's course (*i.e.*, the eliminating course) will consist of a circuit of Great Britain, including England, Scotland, Northern Ireland, the Isle of Man and Wales:—

HATFIELD	Start		
NEWCASTLE-UPON-TYNE	Turning Point	240	miles.
EDINBURGH	Turning Point	90	,,
GLASGOW (Renfrew)	Control	41	,,
NEWTOWNARDS (Northern Ireland)	Control	104	,,
BLACKPOOL	Turning Point	120	,,
WOODFORD	Control	50	,,
CARDIFF	Control	136	,,
SOUTHAMPTON (Eastleigh)	Turning Point	86	,,
READING	Turning Point	43	,,
HATFIELD	Finish	37	,,
	Approximately	947	miles.

The course for the final will consist of a number of laps of a circuit of not less than fifty miles with an approximate total length of 350 miles, starting and finishing at Hatfield. Particulars of this course will be issued later.

The entry fee is £10. This fee must be paid to the Royal Aero Club, 119, Piccadilly, London, W.1, not later than 5 p.m. on July 15. Late entries at double fees will be received up to 5 p.m. on July 30.

The Late John Tranum

It is with regret that *Flight* records the passing of John Tranum, the famous parachutist, who died when he was about to embark on a 30,000 ft. parachute jump last Thursday. He was a passenger in a Danish military machine flown by Capt. Laerum, and intended to break the world's record for a delayed drop. When the machine reached a height of 27,000 ft. he collapsed, after signalling to the pilot that something was wrong. Capt. Laerum dived for Kastrup aerodrome but on landing it was found that Tranum was unconscious, and all efforts to revive him failed. At the official enquiry into the tragedy it was concluded that death was due to heart failure resulting from nerve strain.

Tranum, a Dane by birth, performed some of the more spectacular of his "stunts" in America, but in England he is, perhaps, best known for his delayed drop of 17,250 ft,. made at Netheravon in May, 1933.

Correspondence

The Editor does not hold himself responsible for opinions expressed by Correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.

THE GERMAN VIEW

[3019] I read with interest the leading article, "Germany and the Air Pact," in *Flight* of February 28. May I add a few comments? Most certainly the new Germany does not want war. Adolf Hitler and those who have gone through the last war know too much of its horrors to start a new one. We only want to be left in peace to recover slowly from the terrible effects of the last war, and the so-called Peace Treaty of Versailles. A new war would be absolute suicide for us.

We want equality at last as a matter of national honour. What would the British say if they were asked to renounce essential means of their defence whilst other nations maintained these weapons? We are no less proud of our national honour.

For years we have waited at Geneva for the other nations to disarm following our own disarmament, but in vain. Now Germany has taken its fate into its own hands, and will no longer be influenced by those who reject its equality. But we are still ready for any reasonable international agreement on the basis of equality, also in the question of disarmament, and we earnestly hope that an international air pact will be reached.

Our desire for peace is proved by the German-Polish pact and by the German-French agreement on the Saar. Nobody other than Adolf Hitler could have dared to put aside the question of the Polish Corridor and to have given up Alsace Lorraine! Germany has the most sincere goodwill for peace and international understanding!

Belgard, Germany. BARONESSE VON DER GOLTZ.

SAFEGUARDING OF PASSENGERS

[3020] I read with interest and disappointment the paragraph in your issue of February 28 relating to "Safeguarding the Passenger."

I feel it proper to declare that, *by no stretch of imagination could the Air Ministry in general or the small operator in particular* be held responsible for deliberate, silly or rash acts on the part of passengers in fits of temporary insanity. Indeed, it might be just as wise to suggest the exterior locking of railway doors or the removal of railway lines, or even the enclosing of ship decks by wire netting. The Air Ministry, I am sure, has ample work to occupy its attention, and could ill afford to waste time over an issue of this nature.

Again, the opening of the door by contact with the ground after landing would appear to prevent the escape of travellers by parachute in the event of an emergency; this, however, is beside the main purport of my letter. D. M. R. MEHTA.

London, W.C.1.

THE FLEDGLING COMMERCIAL PILOT

[3021] As one who habitually leaps, pen in hand, to attack any article in every paper, I feel somewhat diffident in leaping forward to *defend* an article.

But Mr. Frost [letter 3015, last week] appears hardly to have glanced at the "Outlook" paragraphs which he criticises. The writer, as I understand him, did not "express surprise at the shortage of good transport pilots," but merely produced the fact like any conjuror, as a "surprising paradox." A conjuror is never surprised.

The writer admitted, too, that the operator could not afford to run instructional services and suggested that the dear Air Ministry should foot the bill. Personally, as a passenger, I should be charmed with the thought that my pilot had been over the route a few times with an old hand.

Finally, the paragraphs did not suggest that the second pilot scheme was a washout, but remembered that small operators did not run *big* machines with dual control and suggested that "the problem was not *completely* solved thereby." Neither is it solved, as Mr. Frost suggests, by carrying a new pilot as mere ballast—he must *fly* the machine himself. To stress this point was, one presumes, the main reason for the appearance of the paragraphs. "DEFROSTER."

London, S.W.3.

"FEET-OFF" FLYING

[3022] An article which appears on page 239 of *Flight* of March 7 states that certain aircraft of recent design are so "proportioned . . . that all normal turns can be made without touching the rudder bar," and it would appear from the article that this is a newly discovered feature.

This has always been a characteristic of the Percival "Gull" and of the "Mew Gull."

These machines can be flown into not only a "normal turn" but into a vertical turn in either direction, and from this to a vertical turn in the opposite direction and back to a straight and level course again without touching the rudder bar, and these manœuvres can be carried out from engine "off" to engine "full on."

It is naturally a desirable feature of any aeroplane, and should be aimed at by any aircraft designer or constructor. When achieved in the "Gull" several years ago it was not considered to be an unusual or unique feature, and no very special claims were made for it, any more than claims would be made for a motor car that kept on a straight course or had automatic centring of the steering if the steering wheel is left untouched. E. W. PERCIVAL.

London, W.1.

A "POU-DU-CIEL" LEAGUE?

[3023] Now that leagues of air-minded people are all the rage, could not we have one which would serve the interests of its own members and no one else? A really genuine league which unequivocally proclaimed to the world what it was for, made no bones about being all for itself, and unashamedly used its name to advertise its purpose.

How about a "Sky-lice League"? A good, short, descriptive name, indicative of the growing number of people who are building, or want information about the possibilities of building, the tiny French "*Pou-du-Ciel*" monoplane. The members wouldn't be using aviation for ulterior motives, they'd be banded together for the furtherance of their own hobby—parasites in name only! Picture the future coveys (or should it be gaggles?) of junior "Lice" flying their little *Pous* over London in the evening, sitting on the thermal currents which rise warm and comforting from the houses of their betters; each covey (or gaggle) guarded by a senior, just in case a bold, bad baron should send into the sky a flock (or should it be swarm? wasps swarm, don't they?) of his nasty, military-minded insects to prevent our happy "Lice" from monopolising London's hot air. J. FROST.

Kensington.

Forthcoming Events

Club Secretaries and others are invited to send particulars of important fixtures for inclusion in this list.

Mar. 15. "New Developments of the Autogiro." R.Ae.S. Lecture by Senor Juan de la Cierva.
Mar. 15 Annual Dinner and Dance. Cinque Ports Flying Club, Royal Pavilion Hotel, Folkestone.
Mar. 16. Dinner and Dance, Masonic Country and Flying Club.
Mar. 20. Annual General Meeting, R.A.F. Club.
Mar. 23. Rugby: R.A.F. v. Army, Twickenham.
Mar. 29. "Piloting Commercial Aircraft." R.Ae.S. Lecture by Sqn. Ldr. H. G. Brackley.
Mar. 29. Annual Dinner. Norfolk and Norwich Aero Club, Mousehold Aerodrome.
Apr. 12. "Commercial Aircraft." R.Ae.S. Lecture by Capt. G. de Havilland.
May (Date not yet fixed). Wilbur Wright Lecture, R.Ae.S. by Mr. Donald W. Douglas.
May 5. R.Ae.S., Garden Party, Fairey Aerodrome, Great West Road.
May 29. Household Brigade Flying Club. Night-Flying Demonstration, Heston.
June. 1. Brooklands "At Home."
June 8. London Aeroplane Club. Garden Party, Hatfield.
June 15. R.A.F. Flying Club Annual Display, Hatfield Aerodrome.
June 29. Royal Air Force Display, Hendon.
Aug. 24-25. Third International Flying Meeting, Lympne.
Sept. 6-7. King's Cup Air Race.

THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS

From India to South Africa

The first passenger, Mr. Desmond Young, editor of the *Lucknow Pioneer*, to fly between India and Cape Town, covered the journey in eleven days. Had he used any other means of transport it would have taken five weeks!

Four-mile Parachute Jump

The Soviet parachutist Kaitanoff claims to have made a parachute drop from a height of 23,000 ft. without the use of oxygen apparatus and in a temperature of 41 deg. below zero. The late John Tranum jumped from 21,000 ft., falling 17,250 ft. before opening his parachute.

Serious Spanish Crash

While making an unauthorised flight over Madrid last week a civil aeroplane crashed into a girls' school. One of the airmen and one of the children were killed, and the other airman, two teachers, and seven children were seriously injured.

A Modern Tailor

A tailor living at Dalby, 200 miles from Brisbane, who is a licensed pilot, finds flying to his various customers quicker and cheaper than travelling by land transport. He hires a machine from the local flying club, and often carries out "rounds" to customers fifty miles apart, being back at work on his orders the same day.

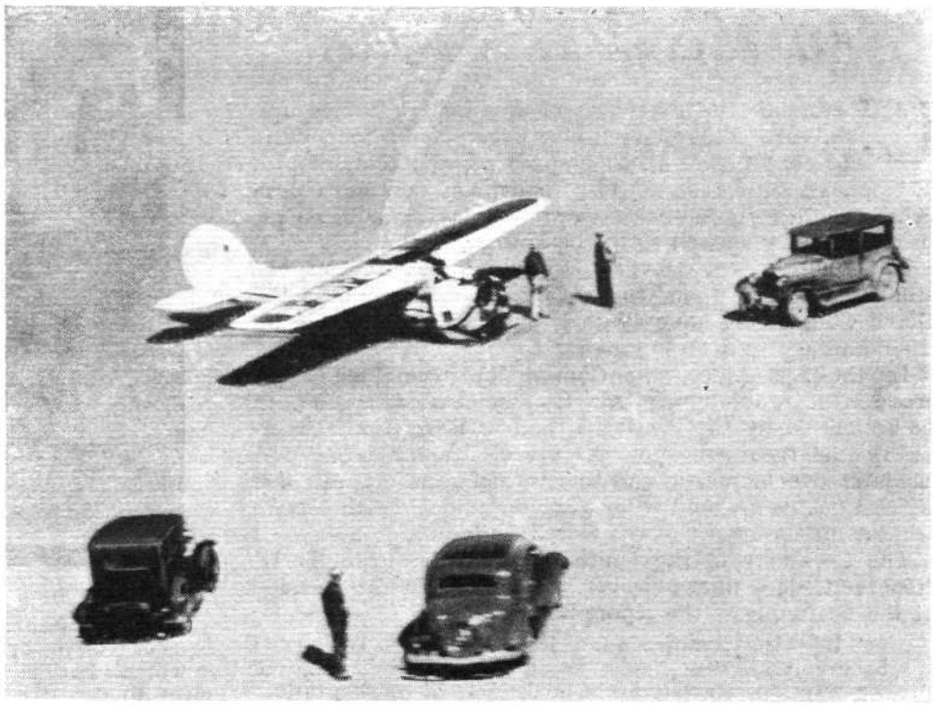
Campbell Black's New Venture

"Campbell Black (Aviation), Ltd.," was registered as a private company last Thursday. The objects of the company are to operate all kinds of air transport services for mails, passengers and freight, within the United Kingdom and outside. The nominal capital is £2,000 in £1 shares, and the directors are announced as T. Campbell Black and Florence E. Dawson. The last named is better known as Miss Florence Desmond, the actress.

Twenty-five Years Ago

From "Flight" of March 12, 1910.

"Second Olympia Aero Show.—We cannot imagine anyone visiting the present Aero Show without being deeply impressed with the extraordinary development that has already taken place in this embryonic industry. . . . To find in the list of aeroplanes alone over a score of different names is to realise . . . that the manufacture of flying machines is already an established business in Britain. . . . Considering that the industry started in France, and bearing in mind the reputation for going slow, which is so often attributed to this country, such evidence of activity at this early stage of the proceeding is commendable, to say the least."



A "ONE-POINT LANDING": Wiley Post's Lockheed "Vega," *Winnie Mae*, after landing—minus the undercarriage—in the Mojave Desert, where it was forced down during an attempted stratosphere flight across America. Only slight damage was done—to the airscrew. Note the skid mark in the sand.

Sahara Air Beacon

The first aerial lighthouse in the Sahara is now in operation. It is situated at Bidon Cinq—the lonely outpost in the heart of Tanezrouft ("the Land of Fear"), comprising a wheelless railway carriage, a Shell fuel and oil dump, and a native attendant!

Lady Hubert Young's Adventure

Lady Hubert Young, wife of the Governor of Northern Rhodesia, who left Livingstone for Lusaka in her aeroplane to join her husband, was missing for four days, having made a forced landing near the Zambesi River, before news of her safety was wirelessed from Gokwe. Numerous aeroplanes, police and natives had, meanwhile, been searching for her and Dr. Kerby, her companion.

"Two Shillings a Foot" Diving

The Northrop Corporation wanted to see one of its new military machines perform a sixteen thousand foot power dive, and, so the story goes, offered some £1,600 to the pilot who would perform this test. Vance Breese, a veteran pilot, volunteered. He had himself taped from head to foot, presumably to help his body to stand the terrific strain of the "pull out," took the machine up to 20,000 ft., pointed its nose earthwards, and kept the 750 h.p. "Twin Wasp" at full throttle. The needle of the A.S.I. had worked round to 425 m.p.h. when the instrument broke, but the Northrop continued on its way, and was safely brought out of the dive at 4,000 ft.

Birmingham's Sky Sign

At the suggestion of the Airport Committee, the Birmingham Corporation Gas Committee has agreed to paint "B/HAM" in 60ft. letters on the crown of the city's largest gas holder.

In the Family

Indians can certainly be air-minded, judging from the fact that Mr. Ramaswami Ayyar, an executive engineer, of Madura, Madras Presidency, is not only a qualified pilot himself, but has also passed on his enthusiasm to his two sons, who are now qualified pilots as well.

"Arc en Ciel" Modified

The Couzinet 70 monoplane *Arc en Ciel*, which has the habit of making successful but unheralded Atlantic crossings, has been modified. The radiators of the three 650 h.p. Hispanos are now of the abdominal type, the chord of the ailerons is increased, and, instead of the familiar large "spats" over the wheels, there are now only tail fairings.

Empire Air Day

It is hoped to make Empire Air Day this year a still larger and more representative affair than it was in 1934, and it is possible that the observance of the day will be extended to India and other parts of the Empire. The Air League of the British Empire has fixed May 25 as the date for civil displays and visits to stations, but the date for the Service arrangements has not yet been decided upon.

AN AMERICAN STOCKTAKING

Some Findings of the Federal Aviation Commission that Have Their Value on This Side of the Atlantic : U.S. "Gorell Committee" Suggested

LAST summer the President of the United States appointed a Federal Aviation Commission to enquire into conditions and to prepare a report covering all phases of aviation. This report has now been published, and it forms a document of immense value to people in this country as well as in the United States.

It would appear obvious that the Commission has studied the lines upon which similar bodies, such as the Gorell Committee, have worked, and has been guided by their findings to a large extent.

In the first place, the Commission recommends the creation of a temporary Air Commerce Commission, to be appointed by the President, and to have broad supervisory and regulatory powers over civil aeronautics, particularly over domestic and foreign air transport. In this suggestion there would seem to be an analogy with certain sections of the report of the Gorell Committee.

The President of the United States, Mr. Franklin D. Roosevelt, does not, however, agree, and in his message at the beginning of the report he states:—

> "In this recommendation I am unable to concur. I believe that we should avoid the multiplication of separate regulatory agencies in the field of transportation. Therefore, in the interim, before a permanent consolidated agency is created or designated over transportation as a whole, a division of the Interstate Commerce Commission can well serve the needs of air transportation. In the granting of powers and duties by the Congress, orderly government calls for the administration of executive functions by those administrative departments or agencies which have functioned satisfactorily in the past and, on the other hand, calls for the vesting of judicial functions in agencies already accustomed to such powers. It is this principle that should be followed in all of the various aspects of transportation legislation."

The Industry

In the general introduction of the report certain matters of extreme interest are brought to light. For example, it discloses that between 1927 and 1929 550,000,000 dollars were invested in aeronautical industries, to which has subsequently been added another 90,000,000 dollars invested in municipal airports. However, a great deal of this has disappeared during the depression, and there remains about 180,000,000 dollars at the present time. Further, we find that 15,000 men and women are directly employed in the manufacture of aircraft, aero engines, and accessories, a further 12,000 in the operation of air lines airports, and flying services, and, finally, 34,000 more in the Government's aviation services, 93 per cent. of whom are in the Navy and Army; this makes a total of 61,000 Americans employed in aviation.

A valuable part of the report is the summarisation of the recommendations, a few of which must be dealt with here.

In the section devoted to air transport it is stated that it should be the policy of the United States to maintain a position of world leadership in air transport and to take such steps as may be necessary to ensure that the most modern and efficient equipment and methods shall be applied on American domestic and foreign air lines.

Domestic air transport operations concerned at present cover daily scheduled routes totalling 133,000 miles. They serve every State in the Union but two, and regular stops are made at 178 cities, while 70 per cent. of the American people live within fifty miles of an air line stopping-place.

From 1929 to 1934 the number of passengers carried per year on domestic air lines increased from 162,560 to approximately 457,000, and the passenger mileage from 31,013,000 to 185,500,000. The passenger traffic on American lines running to foreign countries has risen from 19,495,000 in 1930 to approximately 37,000,000 in 1934.

On the subject of the carriage of mails, the recommendation is conservative, but predicts that the day is not far off when it will be feasible and economical for the Post Office Department to despatch its first-class matter by air; nevertheless, the air transport system can no longer be planned with primary regard to postal needs, as it must be considered as a purveyor of transportation to the community, so that the Government's relationship to the lines must have equal regard to the interests of all users.

Generally speaking, the Commission advocates air mail carriers being paid for actual service performed upon a basis of so-much-per-pound-carried-per-mile-flown.

On the financial side of air line operation the Commission has a considerable amount to say. Its recommendation, in brief, is that the control of a multiplicity of air lines through holding companies should be prohibited. The ownership of stock in air lines by corporations engaged in other activities, or the interlocking of diverse aeronautical interests, should be strictly controlled by the proposed Air Commerce Commission.

It then goes on to advocate that the activities of holding companies and other devices calculated to restrict competition —preservation of which should serve the public interest—must not be permitted. At the present time it does not see any advantage in prohibiting the participation of investment trusts in the financing of air transport companies.

The Commission rather deprecates the appointment of directors to a company by the Government, as it feels that management should remain in private hands, although regulation may be vested in the Government.

Another recommendation, peculiarly topical in view of the large amount of propaganda which has been spread in Europe for and against bombing aircraft, is that "there should be no attempt to require the inclusion of military features in the design or equipment of transport aeroplanes." It is pointed out that air transport serves national defence by maintaining a system of high-speed communications which are available for Government and essential industrial purposes in war as well as peace; it creates a reserve of highly trained personnel which may be drawn on for military purposes, and, at the same time, it is considered that operating personnel would be needed to keep the transport lines open.

Air transport lends support to the maintenance of an industry which also builds military and naval equipment, thus increasing that industry's capacity for wartime expansion. Finally, it maintains a system of lighted and radio-equipped airways of immense military value, but which could not be kept up for military purposes alone.

From this the Commission concludes that the military advantages of air transport depend upon the volume of air transport operation, and that similarity of design between transport and military aeroplanes is merely incidental.

Early extension of American air lines to connect with United States territories overseas is advocated, and the report visualises the institution of trans-oceanic commercial air services in the near future, both across the Atlantic and the Pacific, pointing out that the rate of progress has been such that there is reason to believe it is now possible to start services across both these oceans, making use only of the intermediate stopping places that nature has provided. Peculiarly enough, no mention is made of Seadromes.

In many parts of the report it is unequivocally assumed that American air transport is looked upon as the largest, most efficient, and safest in the world, and this attitude is made even more clear by the statement:—

> "We have no difficulty in arriving at the recommendation that this Government should control air-line development in accordance with the practice generally followed by its neighbours, and that whatever powers it possesses to grant or to withhold privileges desired by others should be used in the interests of securing proper opportunity for American enterprise abroad."

In this connection the Commission advocates action by the Government to oppose the exclusion of American air transport enterprises along great inter-continental trade routes before concessions are made to foreign air lines operating in American territories.

On the subject of gliding, it is felt that practice in soaring flight is of value for the study of atmospheric conditions, and the Commission recommends that some Government inspectors should take a course as soaring pilots. Furthermore, it is suggested that both the Army and Navy should study the usefulness of gliders for training at their elementary schools. Government support for study is advocated, but not the payment of a direct subsidy, as has been agreed in this country.

Turning to matters which affect national defence, the Commission recommends an extended programme of development work, interchange of pilots between the Army and Navy, temporary attachment of pilots to air transport lines, use of civil repair stations when possible for work on military and naval aircraft, strengthening of the reserves of both services, and reconsideration of insurance questions.

It is openly in favour of the further construction and operation of rigid airships, both in naval and commercial service. In the first place, it recommends the immediate construction of a new airship for the Navy, and then the establishment of a transatlantic service to meet the competition of a projected foreign airship line—the construction by the Government of a commercial airship and terminus, to be leased to a commercial operator, is suggested. The Commission also suggests greater production of helium by the Bureau of Mines, and control of its export to foreign purchasers.

On the question affecting the Government control of design and construction of civil aircraft no radical changes are mooted. As a general principle, it is felt that governmental regulation should be at a minimum compatible with public interest, and that inspection should not be imposed on the manufacturer's own inspection system.

The Commission is definitely against adoption of the British method of "approved firms," and also the findings of the Gorell Committee in this connection; it is maintained that governmental control in America has been so good in the past, so sympathetic to the industry's problems and so free from bureaucratic rigidity that there would be nothing to be gained if it were abandoned.

It is advocated that the Department of Commerce should increase the number of international agreements for the mutual recognition of Airworthiness Certificates, and give every assistance to manufacturers of aircraft engines and accessories seeking an export market for their products.

In the matter of research, the Commission suggests increasing the amount of Government research work, while eulogising the amount which has already been done and the benefit which that research has brought to the trade.

FLYING-BOAT *VERSUS* AIRSHIP

SPEAKING at the Women's Engineering Society in London recently, Mr. M. Langley championed the flying boat and the Hon. A. F. de Moleyns the airship.

Mr. Langley maintained that the airship was stressed on a basis of assumptions. In this respect one cannot help thinking that the assumptions which are used for stressing flying boats are not any more valid than those used for airships. He made a good deal of capital out of the fact that slots and flaps had enabled higher wing loadings to be used, but he forgot to mention that alighting speeds have also risen, and that one of the advantages of a flying boat is that a comparatively high landing speed is in no wise to be deprecated so strongly as in land machines

The Hon. A. F. de Moleyns, in advocating airships, stated somewhat wildly that all writers on the subject had damned airships as dangerous and useless because of the crashes with which their development has been associated.

He also spoke somewhat disparagingly of the meals served in flying boats, as compared with those obtainable in airships. We can only imagine that his experience of air lines, such as those of Imperial Airways, must be limited.

Another gentleman who spoke in favour of the airship fell into a common pitfall of those whose experience of the air is limited; he assumed that people were unnecessarily endangered, if not killed, when an engine or engines of a heavier-than-air craft stopped. We can only assure him that this is not the case, and, in fact, is very much the exception rather than the rule.

Italy's Flying City

Guidonia, the new aeronautical experimental centre to be opened on April 21, has been built on the slopes of Montecelio. Every branch of aeronautical study will be available in the town. In the centre stands a huge building for the General Direction. It is divided into three sections, viz.: (1) Flying materials, craft and engines; (2) installations, photography, wireless and instruments; (3) chemical technology. The hydrodynamic tank, built in armoured cement, is 500 metres long and can be extended to 1,000 in case of need. There are six wind tunnels, one of which is 13ft. in diameter and has a wind-speed of 224 m.p.h. Another is arranged for vertical experiment and the total horse power installed is 6,000 h.p. The centralising of all the various branches bearing on aviation is going to be of enormous advantage to Italy, not only from a practical and technical point of view, but from a purely economic standpoint.

A *British "Canon" Fighter*

Lecturing on "The Trend of Development in Military Aircraft" before the Yeovil Branch of the Royal Aeronautical Society, Sir E. W. Petter, M.I.Mech.E., chairman of Petters, Ltd., mentioned that a 37 mm. gun, firing 1½lb. shells, had been fitted to the Westland low-wing monoplane fighter, a type originally produced several years back.

It appears from a photograph that the gun is mounted in the starboard side of the fuselage and fires skywards. With an old-type "Mercury" engine the maximum speed of the machine is 185 m.p.h., but this, stated Sir Ernest, could be considerably increased if the latest Bristol "Perseus" sleeve-valve type were embodied.

Speaking of the "Pterodactyl" Mk.V two-seater fighter, Sir Ernest said that a "hush-hush" power-driven gun turret was being designed for this machine.

Kay Autogiro's Maiden Flight

The Kay Autogiro, which was described in *Flight* of December 27, 1934, has now made its first test flight, in the hands of Flt. Lt. A. H. C. Rawson. He reports that the short trial which was possible on this occasion proved the value of the variable incidence arrangement, both for take-off and landing. No difficulty was found with speeding the rotor up to the required maximum. There was every evidence that the estimated flying speed will be attained after certain small adjustments, which are now in hand, have been finished.

A.I.D.T.S.A. Annual Dinner

The tenth annual dinner of the Aeronautical Inspection Directorate Technical Staff Association will be held on Friday, May 3, at the Holborn Restaurant, London, W.C.2. As in previous years, there are a limited number of tickets available for visitors, at 12s. 6d. each and they are obtainable only from Mr. J. Jarvis, 36, Cambridge Road, East Twickenham, Middlesex.

MODERN AIRCRAFT

Navigation Control Systems Described : Communication Transmitters and Receivers

IT is no exaggeration at all to say that the success of commercial aviation depends entirely on the efficacy and thoroughness of radio communication.

No means of transport is of real use for the carriage of either passengers or mails unless the percentage of trips completed on schedule is very much nearer 100 than 99.9.

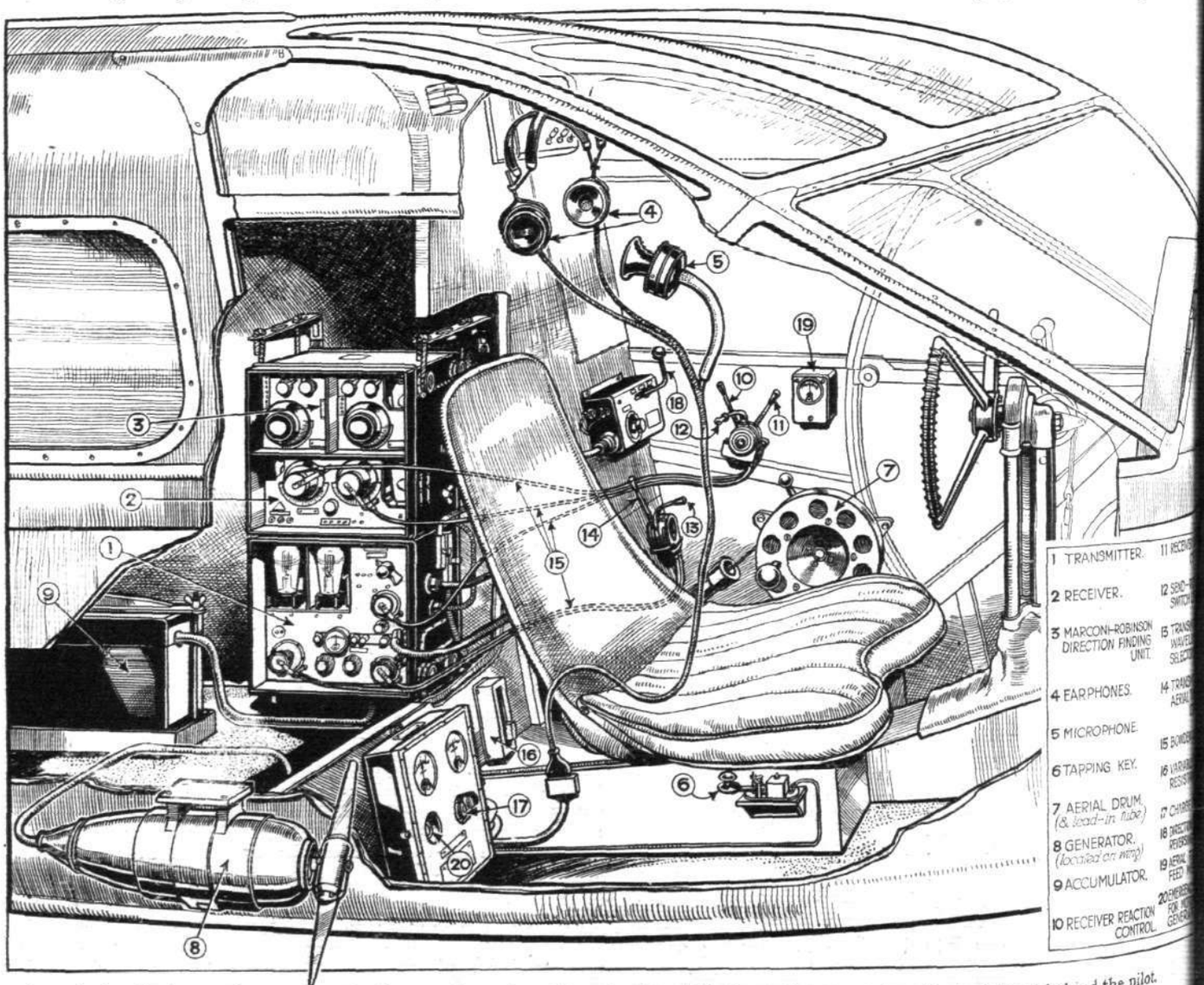
The fundamental difficulty of achieving this regularity in the air is, paradoxically enough, exaggerated by the ability of an aircraft to move in three planes, because it is just that ability which makes the pilot's job very much harder than it would otherwise be when he has to fly through fog or low cloud.

Railway trains, running on rails as they do, only have to have the line in front of them kept clear; thus an efficient signalling system is possible, even in fog. Ships, on the other hand, have no defined and signal-posted track, and fog, therefore, is a greater hindrance to them than it is to trains, and brings their speed down to a larger extent. Finally, we come to the air, where it is possible to travel not only in any direction horizontally, but also upwards and downwards; and this virtually means that a large volume of air completely surrounding every aeroplane must be kept clear if that aeroplane is to be safely flown when the pilot cannot see anything outside his cockpit.

A great deal of experimental work is being carried out in the use of infra-red rays, but so far the only practical means which has been evolved of achieving this desired safety is by a control of aeroplanes through the medium of radio communication to the pilot. The fabric of this control is naturally vast, particularly in a part of the world such as Europe, where different nationalities and numerous national frontiers have to be taken into account. In a country like America these troubles do not exist to such a large extent, and their problems are therefore lessened very considerably.

In Europe it would now seem that the system, by a process of development and evolution, is crystallising into what may be described as zonal control. That is to say, a control officer at a terminal aerodrome is responsible for the safe conduct of all aircraft within a certain radius. He will guide each machine so that it can fly safely without running into other machines. When it reaches the edge of his area he will pass it over to a control officer of the next, and so on.

As is well known, the radio equipment necessary for



A typical radio layout for a modern cabin aeroplane of medium size, in which the set is mounted on the bulkhead behind the pilot. Control is by Bowden-type cables. The equipment shown includes a homing device, the loop aerial of which is wired round the fuselage aft of the cabin.

RADIO EQUIPMENT

Direction-finding Aids : The Leading Sets Reviewed

this form of control may be divided into three main categories. First, there is the radio communication equipment carried in the aeroplane, by means of which the pilot can communicate with ground stations, and, if need be, with other aircraft, although, generally speaking, he does not do so, otherwise the ether would become too congested. Secondly, there is the ground station equipment for communication with other ground stations and with aircraft. Thirdly, there is what may be described as purely navigational equipment, that is to say, some form of direction-finding radio equipment which is partly on the ground and partly carried in the air.

Aircraft equipment, the leading examples of which are briefly described in the following pages, must, of course, be very compact, very light, and simple in operation and maintenance.

Transmitters are normally designed to work either on short waves, that is, from somewhere about 40 to 80 metres, or on the higher commercial wavebands between 850 and 1,000 metres, though for certain classes of work, which for the most part are purely military, wavelengths of round about 600 metres are sometimes used.

The receivers generally cover either the short waveband or the range between 500 and 1,000 metres.

Within limits, there are no restrictions against carrying a radio receiver in any aeroplane; that is to say, private owners and others who wish to hear broadcast talks or music during their flights can install any receiver which is approved by the Air Ministry, and several private owners have small receivers which enable them to hear the weather forecasts which are broadcast for their benefit.

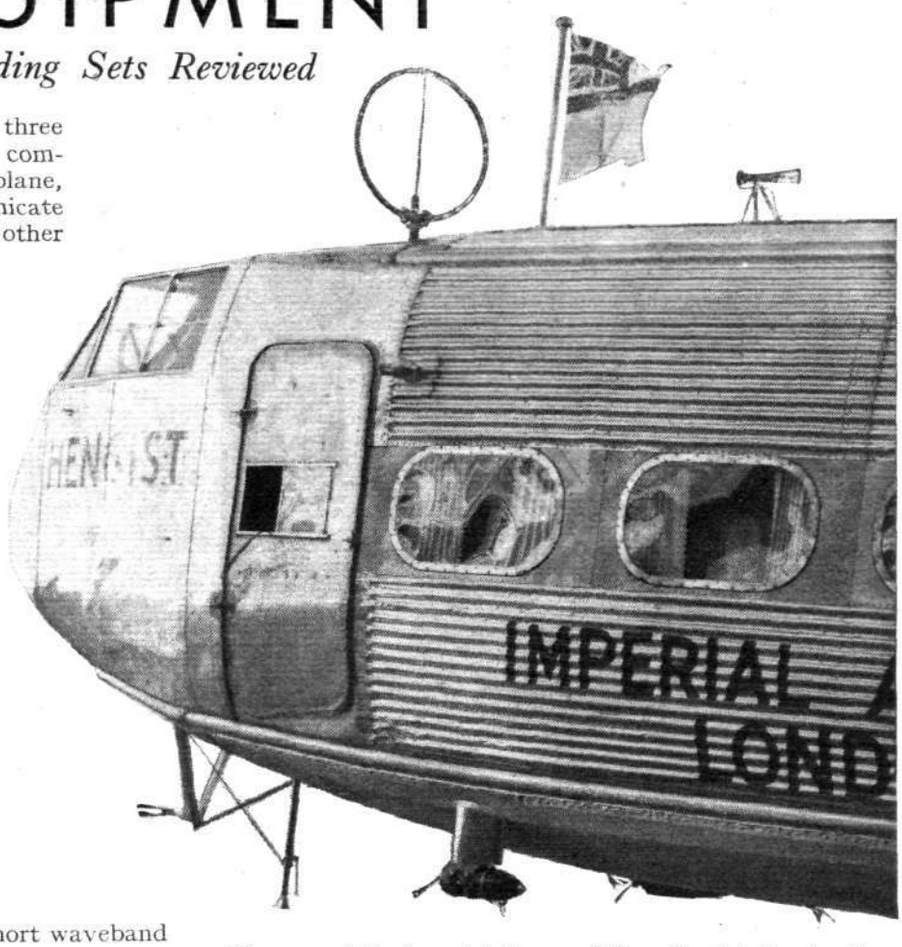
Fitting radio transmitters is, however, a very much more difficult matter. Since the safety of all aircraft in the air during conditions of bad visibility depends to such a large extent upon radio, it is obviously impossible to permit uncontrolled and promiscuous transmission from the air. The use of transmitters is, therefore, confined to aircraft on scheduled air lines, and to those of certain responsible charter pilots and taxi operators.

The wavelengths allotted for ordinary aircraft transmission are 862, 900, 923, and 932 metres, and already the congestion on these, in a zone like that controlled by Croydon, is so bad as to constitute, in some people's minds, a danger.

In the aircraft itself the actual equipment is more often than not at some little distance from the pilot or operator. In medium-sized aircraft this is almost always the case, although in some of the largest it is now possible to find sufficient space to have the sets arranged in a compartment where they can be in charge of a wireless operator. When they are not placed close to the pilot some form of remote control is necessary.

The sets manufactured by Marconi and Standard make use of Bowden-wire type of controls for both the necessary switches and tuning controls. Plessey, however, has evolved a system of electrical tuning which enables the pilot to have a small tuning unit close to his hand, while, as there is no possibility of backlash with this form of control, the set itself can be placed anywhere in the machine where it is convenient.

The remainder of the equipment, consisting of an aerial,



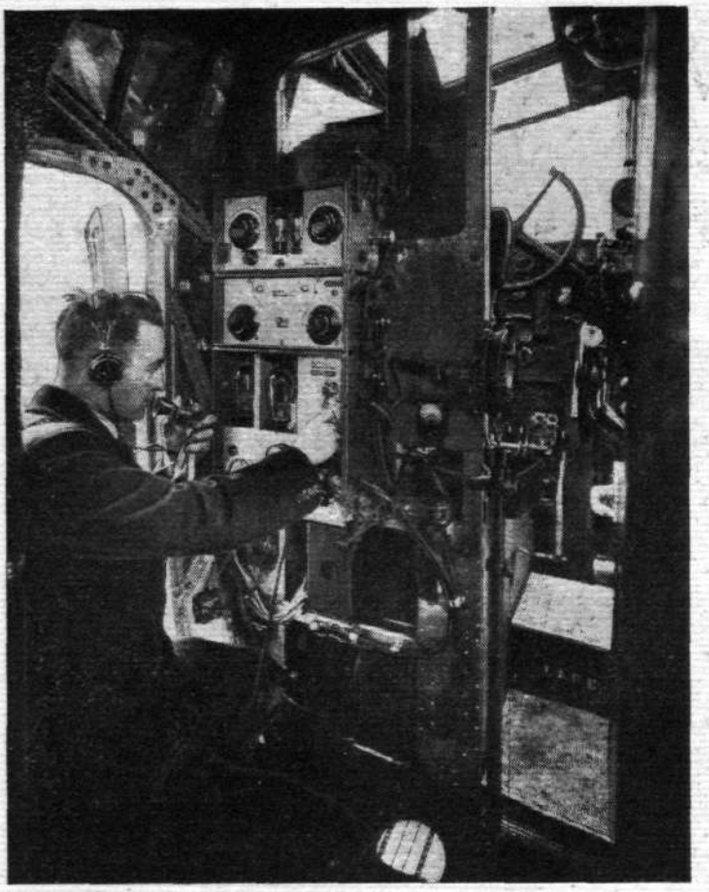
The nose of the Imperial Airways H.P.42 *Hengist*, showing the rotating loop aerial used in conjunction with the Marconi-Robinson homing device.

wound upon a reel, a tapping key, head-phones, microphone, and in some cases a voltage regulator and ammeter, are all placed within easy reach of the pilot or his assistant. On some machines a fixed aerial is used, generally strung between the wing tips and the tail. This is sufficient for use when near aerodromes, but the trailing type of aerial, which is lowered from the reel already mentioned, has to be used for general communication.

Power supply is usually derived from a dual-voltage generator which generates both high- and low-tension currents, so that, if necessary, the set can be worked directly from this source, but more usually the low-tension side is also utilised to charge an accumulator from which the lighting circuits, and possibly the engine-starting circuits, are fed. The generator itself may be either wind- or engine-driven. On some machines only a low-tension generator is carried, and the supply for the high-tension side of the wireless equipment is produced by a rotary convertor run from an accumulator.

The other equipment also installed in aircraft, and which we have already mentioned as being purely for navigational purposes, consists of direction-finding apparatus. Direction-finding can be divided into three classes. The first, and certainly the most common, is that which is used on most of the European air lines; it is operated entirely from the ground, that is to say, three stations are equipped with some form of direction-finding apparatus, one of the three stations usually being the main control station. In our case Croydon generally fulfils this function, and Pulham and Lympne act primarily as direction-finding stations.

The pilot of the aircraft sends out signals asking for his position. These are received by one of the stations mentioned, generally Croydon, which instructs him to continue



The wireless cabin of an Imperial Airways H.P.42, showing the Marconi Type A.D. 41/42 equipment, with homing device (at top). The aerial winch can be seen by the door leading to the pilots' compartment.

running his generator or transmit a certain note. Lympne, Pulham and Croydon then all take bearings on these signals. These bearings are transmitted to the control tower at Croydon, where they are laid off on a map, and the position at which they cut is then indicated to the pilot of the aircraft. Should this full organisation for some reason not be working, the pilot can obtain a bearing from any one of the three stations. This system of control has the advantage that it does not necessitate carrying any equipment in the aircraft except that used for radio communication.

Another form of direction-finding apparatus is the homing device, whereby an aircraft itself can be flown direct towards any station which is sending out radio transmissions. A reading of the compass then gives the pilot the bearing of that station. This is of particular value where there are no regular ground direction-finding stations. A development of this system is now in the course of evolution. This makes use of a rotatable loop aerial, and thereby obviates slewing the aircraft itself: in some cases the reading is shown on a dial, which gives a bearing relative to the aircraft's head.

The final form of navigational aid described in the following notes is the visual or audible beacon. This is in two forms, one for use on air routes and one for landing. The former necessitates the aircraft carrying a special small receiver by means of which the pilot can tell whether or not he is flying directly along a radio-beacon transmission. This has been widely used in America, but in England, where it is vitally necessary for a control officer to keep track of every single aircraft, the cross-bearing system from the ground direction-finding stations is generally considered to be more applicable to the circumstances.

Now to deal with actual equipment. An interesting example is the Marconi A.D. 41/42, shown above.

Two editions of this type are available, one of full power for use on large civil, military and naval aircraft, and one of reduced power for medium-size machines. It provides for telegraphy by C.W. (continuous wave) and I.C.W. (interrupted continuous wave), and telephony, both the transmitter and receiver being designed to cover a wavelength band of 500 to 1,000 metres.

The transmitter incorporates two power magnifiers, one "drive" stage and one modulator. The power rating is 170 watts to the anodes of the magnifier valves on C.W. telegraphy at full power, and 100 watts on reduced power.

The dial of the variable condenser controlling the drive circuit is calibrated in metres, permitting the rapid adjustment of the transmitter to any desired wavelength within the limits of the set.

The method of modulation is by direct-current grid control, so that the modulation valve acts as a variable leak across the grid circuit of the magnifier valve, ensuring full deep modulation.

Various Range

Under good conditions the air-to-ground range for telephony is 250 miles on full power, and 200 miles on reduced power; for I.C.W. telegraphy it is 300 miles and 250 miles; and for C.W. telegraphy 500 miles and 375 miles.

The receiver is continuously adjustable over the same wave-band as the transmitter, and makes use of one screened-grid H.F. amplifier, one detector with reaction coupling, and one pentode output. Power supply is normally derived from a wind-driven generator providing both high- and low-tension outputs.

Remote control of both transmitter and receiver and the tuning adjustment are arranged through Bowden-type cables.

Intercommunication apparatus can be supplied, and enables either the pilot or an operator to use the set, and also affords a means of communication between them.

For normal use over long ranges a trailing aerial is fitted.

The weight of the transmitter is 25lb. 4oz. and of the receiver 11lb. 14oz. The dimensions of the former are 15in. by 14½in. by 8¾in., and of the latter 7in. by 14½in. by 8¾in.

Another set, designed for military machines of the fighter class, is the Marconi A.D. 43/44. It gives communication by telegraphy on C.W. and I.C.W. and by telephony over a wave-range band of 50 to 100 metres. The transmitter incorporates a pentode valve used as a combined master oscillator and magnifier, and a second pentode valve used as a combined

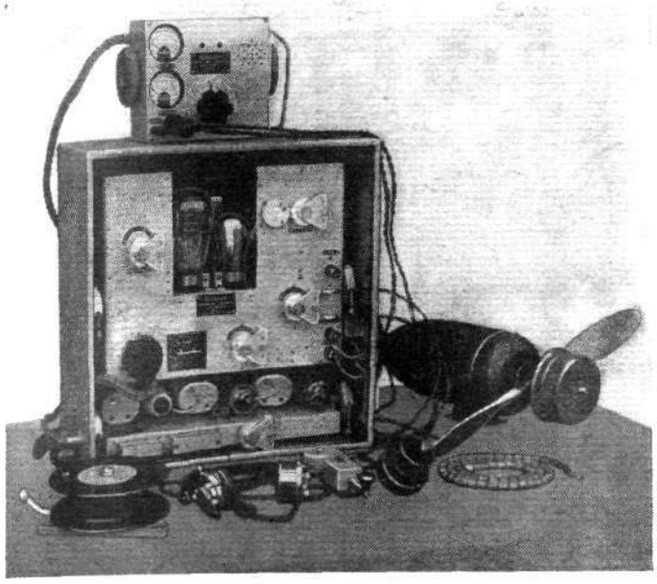
Marconi short-wave equipment Type A.D. 43/44 fitted in a fighter. Note the welded-aluminium-tube cradle, within which the set is suspended by rubber cords.

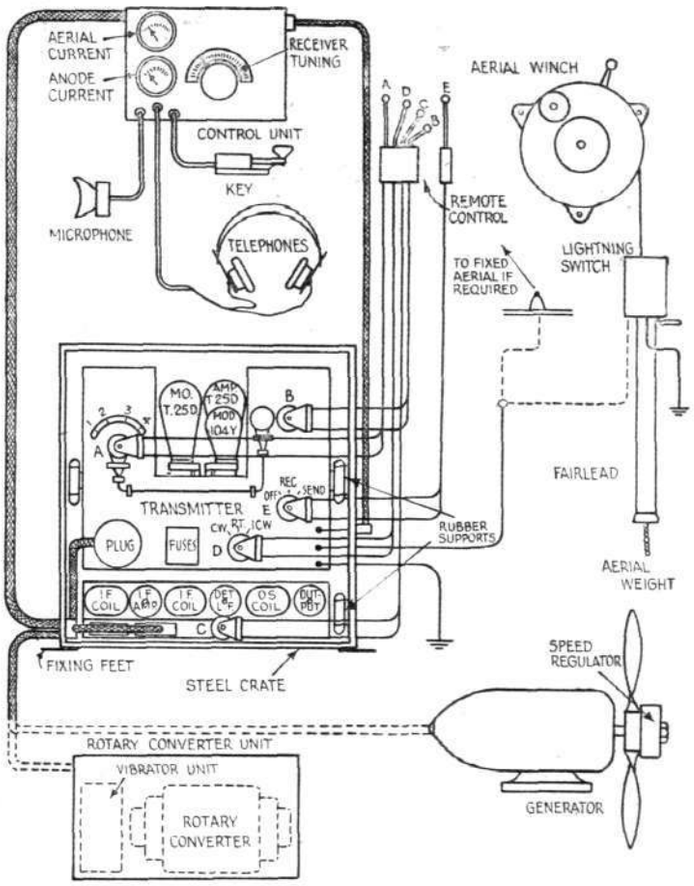
modulator and sub-modulator. The tuning control of the master oscillator circuit is calibrated directly in metres. Power rating of the transmitter is up to 20 watts, approximately, to the anode of the magnifier valve.

The receiver is a six-valve superheterodyne.

Under average conditions it should be possible to obtain a range of 60, 50, and 38 miles for C.W., I.C.W., and telephony respectively, while for inter-aircraft work these ranges would be approximately nineteen, twelve, and nine.

With dual generator and remote control the approximate weight of the complete equipment is 65lb., while the dimensions of the transmitter are 14 1/16in. by 15in. by 6⅝, and of the receiver 7 1/16in. by 15in. by 6⅝.





The Plessey Type A.C.44, with generator, aerial and telephone equipment. On top is the electrical remote control unit. The diagram on the right shows the general layout.

A medium-wave equipment for military and naval aircraft, artillery co-operation and reconnaissance is the Marconi A.D.45/46. It provides communication by C.W. and I.C.W. telegraphy, and telephony, the transmitter covering a wavelength of 200 to 600 metres, and the receiver from 200 to 1,200 metres. The transmitter and receiver are contained in metal cases, which can be suspended as one or two separate units.

Under normal working conditions the ranges which should be obtained are 60 miles, 45 miles and 30 miles for C.W., I.C.W. and telephony respectively.

As is general with Marconi apparatus, power is derived from a wind-driven generator supplying current both for the anode circuits and for filament heating.

The transmitter has a power rating of 20 watts to the anode of the magnifier valve. For C.W. telegraphy the grid of the drive and magnifier valve is connected to the H.T. supply, which in turn is connected *via* a resistance to earth; the grids thus have a negative potential, preventing oscillation. When the key is closed the grids and negative H.T. are connected direct to earth, removing the bias and allowing the circuit to oscillate. For telephony the choke-control method of modulation is used, the inner grid of the modulator pentode forming the sub-modulator stage and the anode of the modulator stage. A side tone device enabling the operator to listen to all types of transmission is incorporated. The dimensions are 9in. by 14½in. by 7in., while the approximate weight of the complete equipment is 75lb. 8oz.

The receiver has one screened-grid H.F. amplifier, one detector with reaction coupling, and one pentode output, all of the indirectly heated type. The single tuning control is calibrated in metres, and, in addition, there is a reaction control and two-position wave-range switch. The dimensions are 7⅞in. by 14½in. by 7in.

So much for Marconi communication apparatus. There are, in addition, direction-finders of the Marconi-Bellini-Tosi system, and the Marconi-Robinson homing system. The first of these is a system of direction-finding which provides a quick and reliable method of obtaining either a position or a bearing from known ground stations or radio beacons. It is particularly suitable for large aircraft carrying an operator and flying over country where no ground direction-finding facilities or beacon transmitters are situated. The use of this unit necessitates two loop aerials fixed at right angles to each other, known as the wing loop and the fore-and-aft loop, as, in wooden machines, they are most conveniently attached to the wings and fuselage respectively.

The Marconi-Robinson homing device is more particularly suitable for use on small aircraft in which no operator is carried, when flying over routes where no ground direction-finding facilities are available, but where ground indication or beacon transmitters are situated along the line of the route. It may be used for either a fixed or rotating loop, the latter enabling the homing attachment to be used as a normal form of direction-finder for check bearings.

This homing device depends for its efficiency on the fact that when an aircraft is not flying head-on towards a transmitting station, an E.M.F. depending on the angle of divergence, will be induced in a loop aerial, and the transmitted signals will be heard by switching the trailing aerial into the circuit, the resultant signal strength will be greater if the loop aerial is connected to the receiver in one direction and less if the loop aerial connections are reversed. From this it can be determined whether the transmitting station lies to the right or left of the fore-and-aft axis of the aircraft. By correcting the course of the aircraft until no difference in signal strength can be noted whichever way the loop is connected, the aircraft will automatically be headed towards the transmitting station.

Other navigational aids which are being developed are based on the Radio Azimuth and Simon's Radio Range and Direction Finder, but no details of these are yet available.

Electrical Remote Control

Turning to Plessey productions, the A.C.44 is a medium-power equipment intended for use on civil and military aircraft where telephony, C.W. or I.C.W. communication is required. The transmitter can be either of two types. There is the A.C.44, operating on four pre-set wavelengths anywhere between 600 and 1,000 metres. For normal use in this country these are 600, 862, 900 and 930 metres, but in special cases wavebands other than 600 to 1,000 metres can be provided. Secondly, there is the A C.44B, which operates anywhere over the 550 to 1,000 metres band, and not only on pre-set wavelengths.

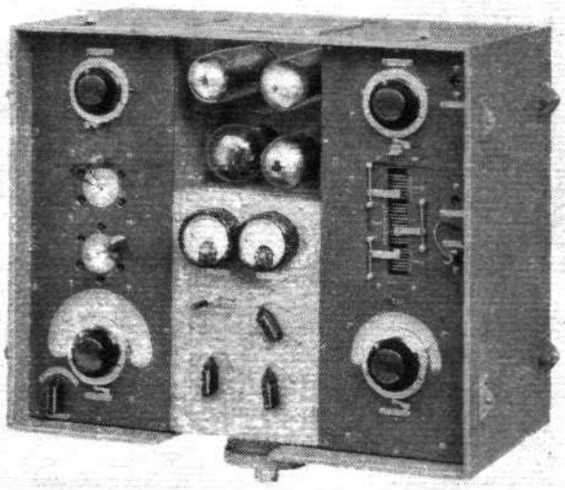
Each type employs a master oscillator for frequency control, driving two amplifier valves in parallel, the anodes of which are connected to the aerial circuit through a special coupling circuit which prevents overloading of the amplifiers should the aerial be lost or the aerial circuit detuned.

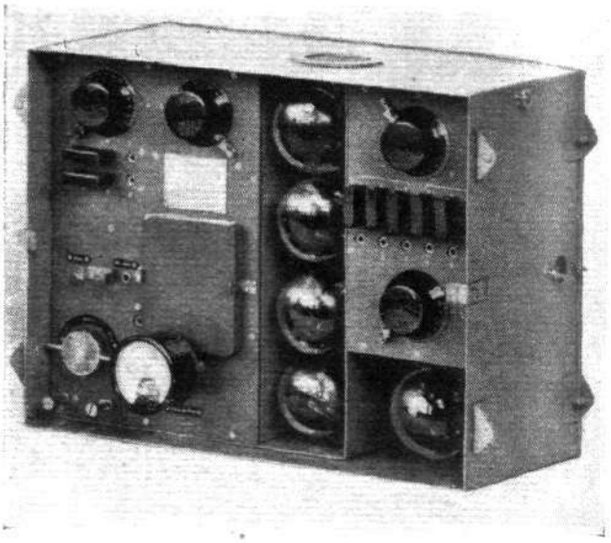
Telephony and I.C.W. are obtained by means of a low-power modulation system giving approximately 70 per cent. modulation.

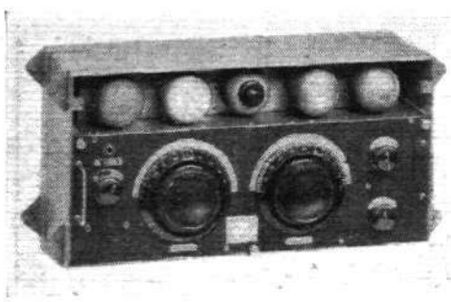
The output of the aerial is 36 watts for C.W. telegraphy, and 18 watts for telephony or I.C.W. telegraphy. The air-to-ground range under normal conditions is 200 miles for telephony and I.C.W. and 500 miles for C.W. telegraphy.

The transmitter unit is carried on a lightweight aluminium framework, the master oscillator being entirely screened from the remainder of the circuit. Particular attention has been paid to ease of accessibility, and everything is arranged so that inspection and maintenance are simple matters.

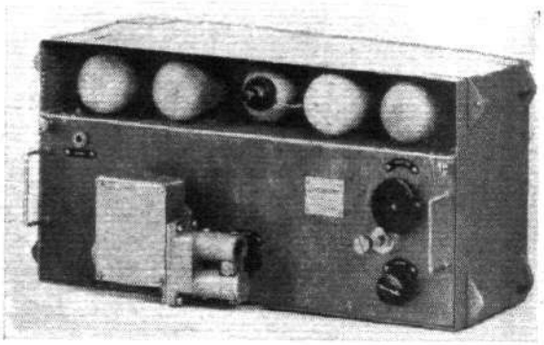
A four-valve superheterodyne with automatic volume control constitutes the receiver. The tuning is electrically performed.







Two Standard Radio equipments. At the top, on the left, is the ATR.6, for medium- and short-wave work on large aircraft; the receiver is shown below it. On the right is the ATR.3, with its receiver unit, intended for short-wave work in fighting machines.



no mechanical controls are employed, and all backlash is thereby obviated.

For the reception of C.W. telegraphy, a local oscillation provides the required beat note, maintained at constant amplitude by the automatic volume control, with the result that the aircraft may fly directly over a station transmitting C.W. telegraphy without loss of beat note, and without interference due to key clicks.

Both the transmitter and receiver are provided with metal bosses carrying flexible rubber rings which are held in special supports inside a welded tubular steel crate; this crate is enclosed by ventilated detachable sides. Thus both the transmitter and receiver are contained in one unit, floating on rubber, and the crate can be bolted direct into the aircraft without any special trouble. For small aircraft, the transmitter and receiver can be supplied in separate crates.

The control unit is particularly interesting, and can be fitted near the pilot when the installation is remotely controlled. It contains a D.C. feed meter indicating the total current consumption, an aerial ammeter indicating the aerial current, three jacks for microphone, telephones and key, and a special receiver tuning control with wave-change switch where the receiver employs two wavebands. It is connected to the installation by a cable carried in a braided sleeve to prevent interference from external sources being picked up on the receiver. Its construction is similar to that of the main installation, except that it is not contained inside a crate, and the supports for the rubber rings are fitted directly to the structure of the aircraft. Five levers provide remote controls through Bowden-type wires for "off-receive-send" switch, "C.W.-I.C.W." transmitter, "C.W-I.C.W." receiver, and wavelength change for transmitter.

A trailing aerial is normally used, but in large aircraft a fixed aerial may be found sufficient.

Power supply is from a dual-voltage wind- or engine-driven generator, although, if required, a rotary transformer can be arranged to run from the aircraft lighting battery.

Including generator and aerial equipment, the approximate total weight of the A.C.44 is 60lb., while the dimensions of the crate carrying the receiver and transmitter are 9in. × 16⅜in. × 17in., and of the control unit 8¼in. × 6½in. × 2½in.

Another Plessey equipment, the A.C.57, is designed to provide telephonic or telegraphic communication on short wavelengths from fixed aerial systems on high-speed military machines. As in the A.C.44, the entire equipment, with the exception of the controls, is carried in a steel crate.

The wavelength range of the transmitter is 65 to 120 metres or 40 to 80 metres, the output power to the aerial being 15 watts. A special valve made under Plessey patents enables a very small and compact transmitter to be built, incorporating a master oscillator circuit having all the frequency stability of a larger transmitter employing a separate master oscillator. Anode modulation providing a depth of 70 per cent. for telephony and I.C.W. telegraphy is employed on the amplifier.

The tuning controls have locking devices so that they can be set at any two wavelengths in the selected band.

Operating either from 70 to 450 metres, or from 40 to 120 metres, the receiving circuit is a six-valve superheterodyne with a H.F. amplifier preceding the frequency-changing valve. Automatic volume control is employed, control of the beat note for C.W. reception being maintained as in the A.C.44. The tuning control is also electrically operated, as in the type of installation already described.

The weight of the installation is approximately 40lb., and the dimensions of the complete crate 8½in. × 15½in. × 7½in.

A Wide Range

There are seven different sets of aircraft radio equipment listed by Standard Telephones and Cables, Ltd. This company operates its own aeroplane for experimental work, and it has been able to correlate the research work of its laboratories and that in the air, with good results.

The company's ATR.2 set is for transmission and reception of telephony, C.W. and M.C.W. (modulated continuous wave) telegraphy on medium and short wavelengths, and it is therefore appropriate for medium- and large-sized aircraft carrying an operator. The transmitter is virtually divided into two units, one covering the 550-1,100 metre waveband, and the other in two-to-one wavelength range chosen between 30 and 120 metres, as, for example, 40-80 metres. The receiver is self-contained, and covers both wavebands without change of coils. The normal supply is from a dual-voltage air-driven generator without accumulators or dry batteries. If required, however, a rotary converter system can be supplied with accumulator, switchbox and charging generator, so that the equipment can be used on the ground. The transmitter circuit is a five-valve one, including a master oscillator to ensure stability. The output power is 20 watts on telephony or telegraphy.

The receiver for medium-wave reception has one screened-grid H.F. stage followed by a detector and L.F. stage. For short-wave reception an oscillator valve and the first detector precede the above valves, thereby converting the circuit into a five-valve superheterodyne. The medium-wave air-to-ground range is from 120 to 150 miles for telephony, and 250 to 350 for C.W. telegraphy. The ground-to-air range from a first-class aerodrome equipment should be about 150 miles for telephony, and 300 miles for C.W. telegraphy.

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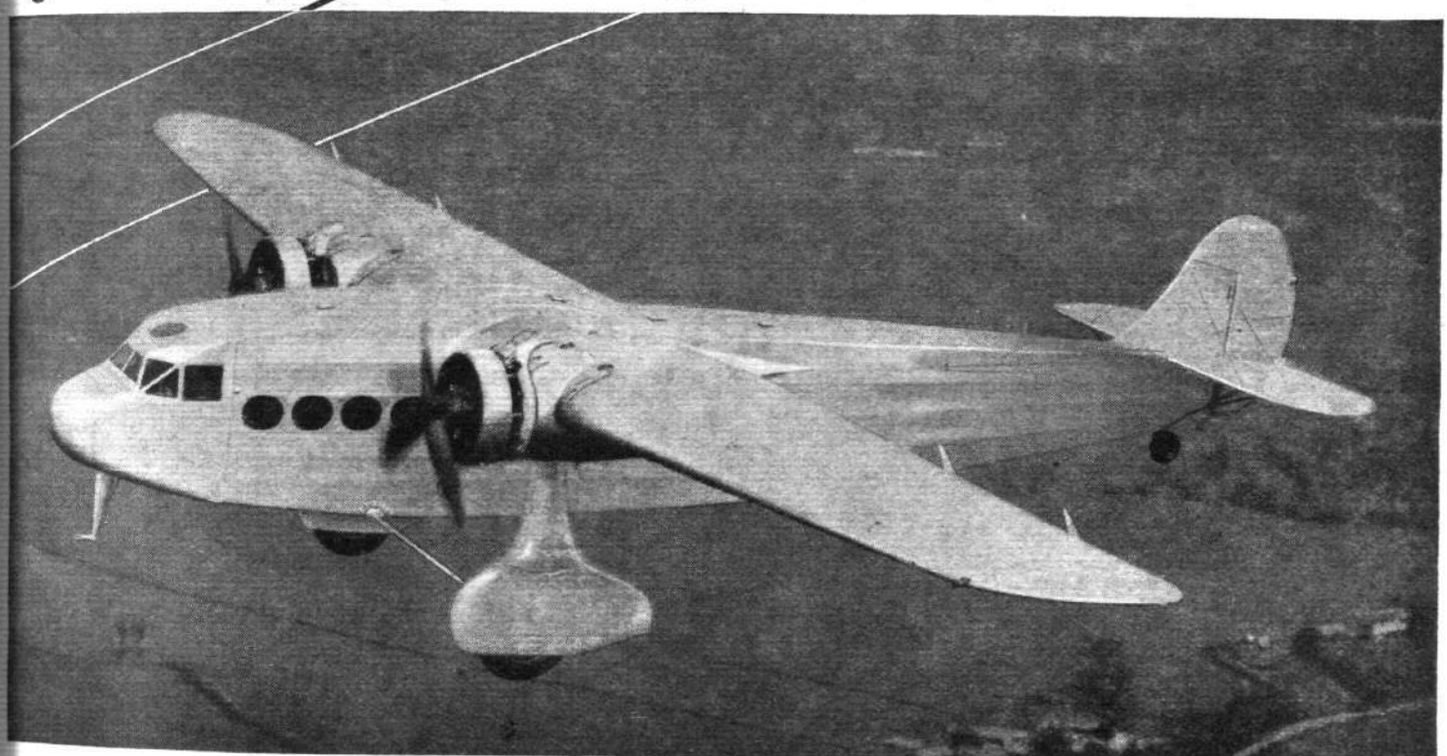

Photograph by courtesy of "Flight"

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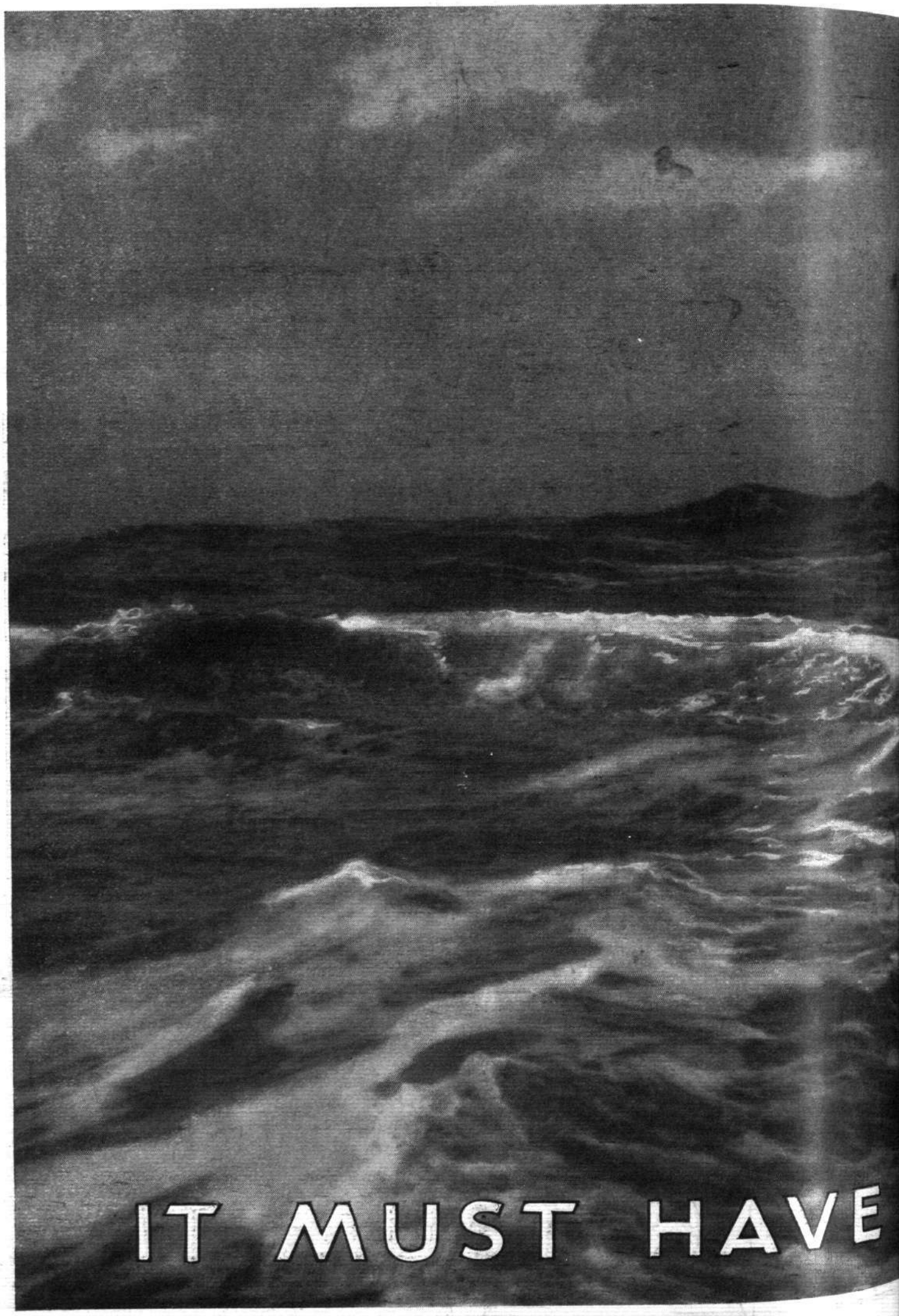
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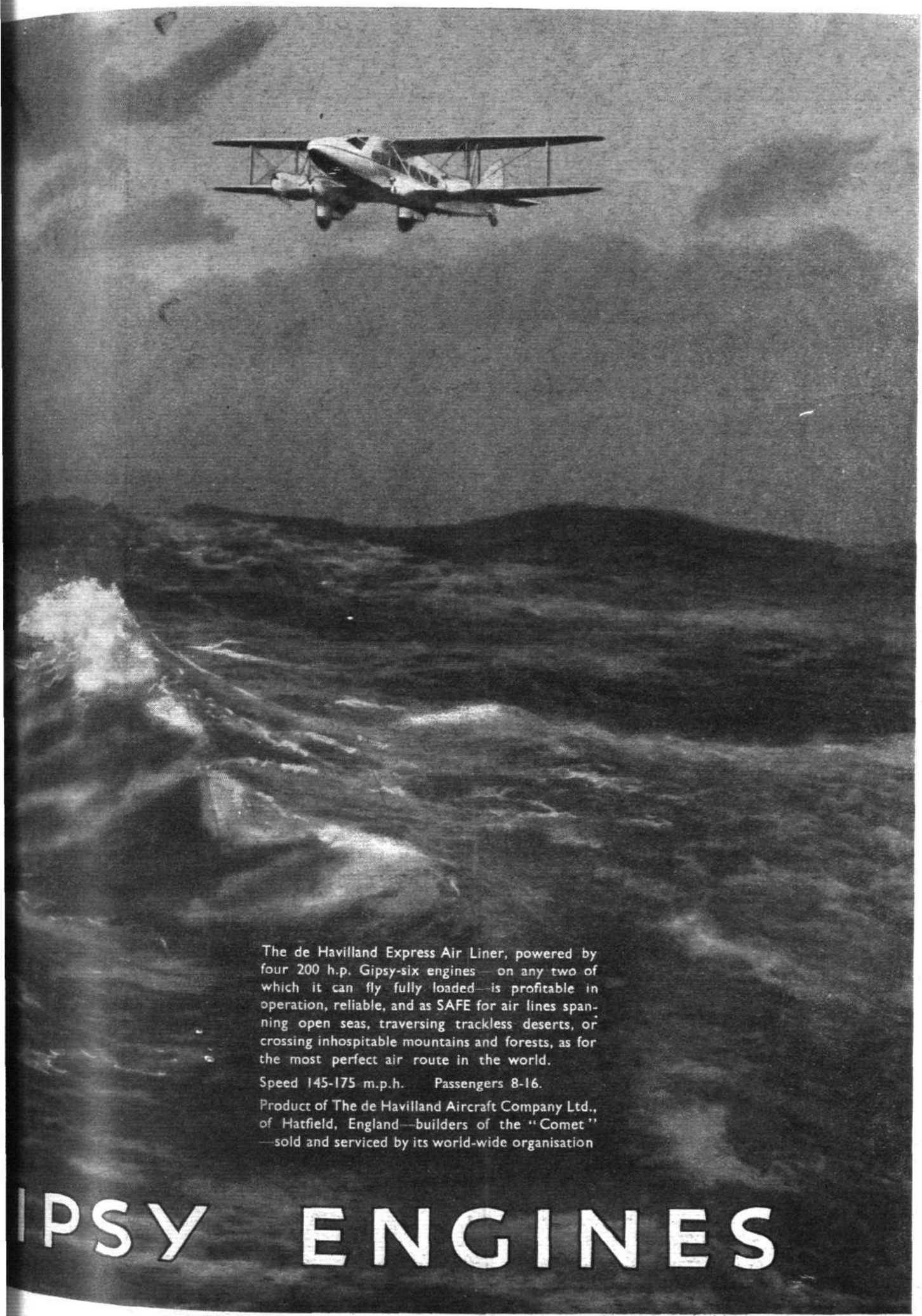
The de Havilland Express Air Liner, powered by four 200 h.p. Gipsy-six engines—on any two of which it can fly fully loaded—is profitable in operation, reliable, and as SAFE for air lines spanning open seas, traversing trackless deserts, or crossing inhospitable mountains and forests, as for the most perfect air route in the world.
Speed 145-175 m.p.h. Passengers 8-16.
Product of The de Havilland Aircraft Company Ltd., of Hatfield, England—builders of the "Comet"—sold and serviced by its world-wide organisation
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Under favourable conditions a range of 1,000 miles or more is obtainable on the short-wave installation. The weight, complete with dual-voltage generator, is 87lb. The height, width and depth of the transmitter are 17in., 14¼in., and 7½in., and of the receiver 7in., 13¾in., and 6½in.

Primarily for use in fighter aircraft, the ATR.3 is arranged only for short-wave telephony, and the set is operated from the pilot's seat by the Bowden wire form of remote control.

Transmission can be made on any two selected wavelengths between the range of 40 to 120 metres, a remote-controlled switch providing a means of changing over. The transmitter circuit employs five valves, including a master oscillator, and the output power is 20 watts.

The receiver is a five-valve superheterodyne, with one remotely operated tuning control. The normal power supply of both high- and low-tension current is taken from the dual-voltage generator.

In good conditions the air-to-ground range on telephony is about seventy miles. The weight, complete with generator, aerial system, and remote controls, is 77lb., while the dimensions of the transmitter are 11in. × 14¼in. × 7½in., and of the receiver 7in. × 13¾in. × 6½in.

The ATR.4 is suitable for general commercial use, and also for military aircraft. It provides transmission and reception over a waveband of from 550 to 1,100 metres. The transmitter has a five-valve circuit, including a master oscillator to ensure stability, and the power output is 20 watts.

The receiver, which has one tuning control, has one screened-grid H.F. stage, followed by a detector and a L.F. stage, all three valves being of the indirectly heated cathode type.

Power supply is from a dual-voltage generator, which can also charge the aircraft lighting battery. The aerial system is normally of the trailing type, but on large aircraft a fixed aerial may be used.

The air-to-ground range is 120 to 150 miles for telephony and 250 miles to 350 miles for C.W. telegraphy. The ground-to-air range of a first-class installation should exceed 150 miles for telephony and 300 miles for C.W. telegraphy.

Complete with generator, aerial, etc., the weight is 74lb., while the dimensions of the transmitter are 11in. × 14¼in. × 7½in., and of the receiver 7in. × 13¾in. × 6½in.

Another Standard installation, the ATR.5, provides communication on telephony, C.W. or M.C.W. telegraphy over any two-to-one ratio waveband within the limits of 30 to 120 metres. It is, therefore, suitable for aircraft from which there is no necessity to communicate on the 900-metre civil wavelength. This is often the case where long journeys over sea have to be made, or in tropical countries where the longer wavelengths are subject to severe atmospheric interference.

The transmitter is of the five-valve type, similar to the other Standard outfits, and having an aerial output of 20 watts. The receiver is a five-valve superheterodyne, with one remotely operated tuning control supplemented by separate reaction and volume controls. A dual-voltage generator provides the power supply, or, as with other Standard sets, a rotary converter driven from the low-voltage lighting circuit of the aircraft, can be used, making possible operation of the installation when the aircraft is on the ground.

Range is, of course, dependent on the conditions; as is well known, these may vary very considerably on short-wavelength working, but under good conditions over 1,000 miles should be obtainable.

The weight, with dual-voltage generator, is 75½lb., and the dimensions of the transmitter are 11in. by 14¼in. by 7½in., and of the receiver 7in. by 13¾in. by 6½in.

The ATR.6, large installation of high power, is intended for use in commercial air lines which carry a radio operator who has direct access to his instruments. The transmitter, which is virtually two instruments in one, operates on any two-to-one wavelength range from 30 to 120 metres or on the medium waveband of from 550 to 1,100 metres. The circuit employs four valves, and the aerial output is 80 watts on telegraphy and 20 watts on telephony, both transmission and reception being possible on telephony, C.W. or I.C.W. telegraphy. For medium-wave reception one screened-grid H.F. stage is followed by a detector and a L.F. stage, while for short-wave reception an oscillator valve and a first detector precede this circuit, making it into a five-valve superheterodyne.

Power is taken from a triple-voltage generator, the low-tension output of which is normally arranged to charge the aircraft lighting battery.

On medium-wave working the air-to-ground range is about 200 to 250 miles for telephony, and 450 to 500 miles for C.W. telegraphy. Under favourable conditions a range of several thousand miles should easily be obtained with the short-wave transmission.

The complete installation weighs 105lb., and the dimensions of the transmitter are 15in. by 18in. by 9in., and of the receiver 7in. by 13¾in by 6½in.

Lastly come two sets which can be dealt with very briefly. The ATR.7 equipment is virtually the transmission and reception medium-waveband part of the ATR.6 equipment. The complete installation weighs 98lb., the dimensions of the transmitter being 15in. by 12in. by 9in., and of the receiver 7in. by 13¾in. by 6½in.

The ATR.8 equipment is, in effect, the short-wave portion for both transmission and reception, of the ATR.6; the weight of the complete installation is 85lb., and the transmitter dimensions are identical with those of the ATR.7.

C. N. C.

Sir Malcolm Campbell's Record

Our readers will join with us in congratulating Sir Malcolm Campbell on his achievement at Daytona last Thursday, when he raised the land speed record to 276.816 m.p.h. His rebuilt *Bluebird* is fitted with a Rolls-Royce Schneider-type engine of 36½ litres.

The previous record, which Sir Malcolm established on February 22, 1933, was 272.108 m.p.h. On Thursday the first run (southwards) was made at 272.727 m.p.h., and the second (northwards) at 281.030 m.p.h.

Sir Malcolm took over his own supplies of Pratt's racing Ethyl petrol, which was used on this record. K.L.G. plugs were also employed, while the oil used in the successful attempt was Wakefield's "Castrol."

Money and the Air Tourist

A paragraph in "The Outlook" page of *Flight* for January 31 has brought to light the fact that other people have also realised the need for travellers' cheques (or something similar) of small denominations. For example, Thos. Cook's now issue such cheques for £2, and they may be cashed at over 30,000 correspondents, branches, banks, hotels and shipping offices throughout the world. Such an arrangement, as we pointed out, is of great value, because the average air traveller more often than not arrives after the banks are shut, and leaves before they open in the morning. Cook's scheme should obviate this difficulty, and at the same time prevent that other bugbear of flying, which is the accumulation of quantities of different currencies which occurs when the tourist carries travellers' cheques of £5, and has to pass through several countries in the course of a day's flight.

Another scheme which would appear to have great value for air travellers is that which has been instituted by Aerocheques, Ltd., of 33, Regent Street, London. This is a system whereby the holders are relieved of the necessity of carrying sums of money while abroad and changing this money into different currencies. Aerocheques are, in effect, vouchers which can be exchanged for service at any one of 3,000 different hotels in fourteen different countries. Moreover, arrangements have also been made at many places whereby the voucher may be used to defray the cost of transport to and from the aerodrome.

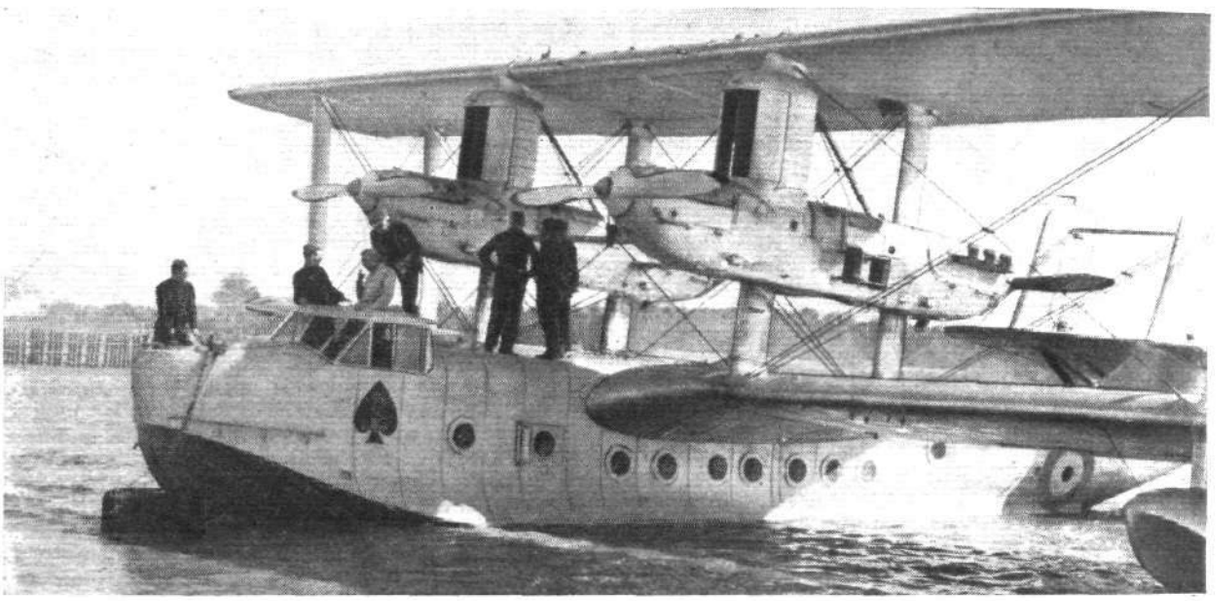
The Loss of the Bristol Monoplane

Everyone will sympathise with the Bristol Aeroplane Co., Ltd., and with Mr. T. W. Campbell, in the loss of the monoplane day and night fighter last week. The machine was one of eight designed and built by different firms for the day and night flying competition, and had been through all its test flights, piloted by Mr. C. F. Uwins, Bristol's chief test pilot, who was entirely satisfied with it.

Mr. "Jock" Campbell was asked to take the machine up for a flight, and when at a considerable altitude he extended the undercarriage and proceeded with his tests. Before beginning a series of aerobatics, the makers state, he omitted to retract the undercarriage, and the machine got out of control. The pilot decided to jump out with his parachute, and made a safe landing. Reports that the machine caught fire in the air can be definitely denied. What may well have given rise to that impression is the fact that the monoplane was metal-covered, and light flashing on its skin might easily have been mistaken for flames.

THE ROYAL AIR FORCE

SERVICE NOTES AND NEWS *AIR MINISTRY ANNOUNCEMENTS*



ON THE TIGRIS: One of the "Singapores" for No. 205 (F.B.) Squadron off Hinaidi. On board can be seen F/O. W. J. Hickey, Sqn. Ldr. A. F. Lang, M.B.E., and Mr. Oswald Short.

HONORARY SURGEON TO THE KING

The Air Ministry announces that the King has approved of the appointment of Air Comdre. Albert Victor John Richardson, O.B.E., M.B., B.Ch., D.P.H., as Honorary Surgeon to His Majesty, vice Air Vice-Marshal John McIntyre, C.B., M.C., M.B., B.Ch., who has vacated the appointment on retirement from the Royal Air Force.

Air Comdre. Richardson was commissioned in the Royal Navy, as a Surgeon, in 1908, and attained the rank of Surgeon Lt. Cdr., in 1914. In October, 1918, he became a temporary Major in the Medical Branch of the Royal Air Force, and was granted a permanent commission as Wing Commander in August of the following year. He was promoted to Group Captain in July, 1927, and to his present rank in January, 1934. During the War Air Comdre. Richardson served in France with the Royal Naval Air Service and received the O.B.E. in recognition of distinguished services during the War. During his service with the Royal Air Force he has held several posts as Principal Medical Officer, and since January, 1934, he has been Principal Medical Officer at the Royal Air Force Headquarters, Air Defence of Great Britain.

MOVE OF R.A.F. UNITS

No. 209 (Flying Boat) Squadron will move from Mount Batten to Felixstowe. The move is to be completed by May 1, 1935.

The Fleet Air Arm floatplane base for Nos. 407 (Fleet Fighter) and 444 (Fleet Spotter Reconnaissance) Flights will move from Lee-on-the-Solent to Mount Batten as soon as possible after May 1, 1935.

FLYING ACCIDENT

The Air Ministry regrets to announce that Sub. Lt. Nigel Radcliffe Williams, Royal Navy, Flying Officer, Royal Air Force, the pilot of the aircraft, lost his life, and No. 563714 L.A/C. Henry John Atkinson is missing and believed to have been drowned, as the result of an accident which occurred off St. Catherine's Point on March 5, 1935, to an "Osprey" aircraft of the Royal Air Force Base, Gosport.

AIR FORCE LIST

The March issue of the *Air Force List* has now been published. It can be purchased (price 2s. 6d.) from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh; 2, York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square, Belfast; or through any bookseller.

EXTENSION OF OFFICERS' SERVICE

The undermentioned officers have been selected for retention on the active list as indicated, in addition to those previously notified:—

PERMANENT OFFICERS TO BE RETAINED TO AGE 45.

Flight Lieutenants—Ralph Horatio Woolnough Empson, Thomas Humble, Cyril Rapley, James George Western, M.B.E., Raymond Whitaker, M.B.E., Noel Vincent Wrigley.

MEDIUM SERVICE OFFICERS—SERVICE TO BE EXTENDED TO COMPLETE 11 YEARS.

Flight Lieutenants—Patrick Edwin Berryman, William Hawkesley Burbury, Arthur Meuric Nairne David, Edward John George, Selwyn Harmar Cecil Gray, Frederick Walter Hick Hall, William Frank Lovering, Edward George Honeywood Russell-Stracey, George Valentine Thorpe Thomson, Patrick Vaughan Williams, Walter George Woolliams.

SHORT SERVICE OFFICERS—SERVICE TO BE EXTENDED TO COMPLETE 6 YEARS.

Flying Officers—John Reginald Shelton Agar, Richard Vernon Alexander, Reginald James William Barnett, John Wilmot Bateman, William John Brighty, Robert Bayne Brown, George Burdick, Graham Routh Canavan, Ronald George Edmund Catt, Arnold Louis Christian, Ronald Neville Clarke, Arthur Edmond Clouston, Hector Ivo Dabinett, John Arnold Dobson, Vincent Philip Joseph Gerald Doherty, Eric Alfred Douglas-Jones, Peter Fidelis Foss, Montgomery Vincent Gibbon, Arthur Philip Glenny, Henry Lawrence Matthews Glover, William Halmshaw, Ronald Hanson, Hill Harkness, Ronald Henry Harris, Horace James Leatham Hawkins, Peter Heylin Hegate, Peter Warren Johnson, Maurice Henry Kelly, Lennox Stanley Lamb, Jack Cuthbert Larking, William Edward Lawley Lewis, Brian Everard Lowe, Ralph Ian George MacDougall, Patrick Herbert Maxwell, Cecil Leslie Monckton, John Ross Palmer, Henry Neville Gynes Ramsbottom-Isherwood, William Arthur Richardson, William Arthur John Satchell, Henry Augustus Simmons, Frank George Laughton Smith, Maurice Robert Desmond Trewby, Arthur William Vincent, John Russell Watson, Reginald Geoffrey Wilde.

AIRCRAFT APPRENTICES AND BOY ENTRANTS WANTED

The Air Ministry announces:—

About 500 vacancies will occur in August, 1935, for well-educated boys to be trained as aircraft apprentices in the following skilled trades of the Royal Air Force:—Fitter, wireless operator mechanic and instrument maker. Full particulars regarding entry and conditions of service may be obtained from the Secretary, Air Ministry

(Apprentices Dept.), Gwydyr House, Whitehall, London, S.W.1. Applicants must have attained the age of fifteen years and be under the age of seventeen years on August 1, 1935. A competitive examination will be conducted at numerous local centres early in June, 1935, the subjects being English and General Knowledge, Mathematics and Science. Applicants possessing an approved first school certificate with specified credits may be excused the entrance examination. No previous trade experience is required. The closing date for the receipt of nominations for the August entry is Tuesday, May 7.

About 200 boy entrants will also be required in September, and candidates sitting at the aircraft apprentice examination for whom apprenticeships are not available, may, if of suitable age and educational attainment, be offered enlistments as boy entrants to be trained in the trades of armourer, photographer and wireless operator.

The Royal Air Force offers excellent opportunities to well-educated boys of securing an efficient training and of embarking on an interesting career with many possibilities of advancement. Aircraft apprentices and boy entrants are housed, fed and clothed free of cost and receive pay. The training is in the hands of well-qualified technical instructors, and boys entering as apprentices continue their general education throughout the apprenticeship period under a staff of graduate teachers.

ARMAMENT TRAINING CAMPS

The armament training camps and ranges are established in order to provide air firing and bombing training facilities for units in home commands as follows:—

Camp.	*Range.*
No. 1 Armament Training Camp, Catfoss.	Skipsea.
No. 2 Armament Training Camp, North Coates Fitties.	Donna Nook.
No. 3 Armament Training Camp, Sutton Bridge.	Holbeach.
Temporary Armament Training Camp, Leuchars.	Tentsmuir.

Accommodation and training facilities are provided at armament training camps as under:—Catfoss, 2 Bomber, G.P. or 1 Army Co-operation squadrons; North Coates Fitties, 2 Bomber, G.P. or A.C. squadrons; Sutton Bridge, 2 Single Seater Fighter squadrons or 1 Single Seater Fighter and 1 Two Seater Fighter or 1 Light Bomber or A.C. squadron. The armament training camps are administered by the Commandant, Air Armament School, for all purposes with the exception of the Temporary Armament Training Camp, Leuchars, which is administered by the A.O.C., Coastal Area.

ROYAL AIR FORCE GAZETTE

London Gazette, March 5, 1935

Air Comdre. A. V. J. Richardson, O.B.E., M.B., B.Ch., D.P.H., is appointed an Honorary Surgeon to the King (March 1), vice A.V.-M. J. McIntyre, C.B., M.C., M.B., B.Ch., who relinquishes that appointment on retirement.

General Duties Branch

P/O. J. G. Davis is promoted to the rank of Flying Officer with effect from Oct. 3, 1934, and with seniority of April 3, 1934. Air Marshal Sir E. R. Ludlow-Hewitt, K.C.B., C.M.G., D.S.O., M.C., is restored to full pay from half-pay (March 2). Flt. Lt. D. H. Carey is restored to full pay from half-pay (Feb. 25). P/O. C. L. Y. Wright is placed on the half-pay list, scale B, from Feb. 20 to 27 inclusive. Sqn. Ldr. A. L. Fiddament, D.F.C., p.s.a., ceases to be employed on the directing staff of the Royal Air Force Staff College and relinquishes the acting (unpaid) rank of Wing Cdr. (March 1). Sqn. Ldr. F. H. Isaac, D.F.C., is placed on the retired list at his own request (March 6). Flt. Lt. E. J. Howes (Lt. R.A.R.O.) is transferred to the Reserve, class C (March 1). F/O. A. C. D. Webb relinquishes his short service commission on transfer to the Royal Australian Air Force Reserve (March 5).

Stores Branch

Sqn. Ldr. A. J. M. Ross, M.B.E., is placed on the retired list (Feb. 28).

Medical Branch

Air Comdre. A. W. Iredell, M.R.C.S., L.R.C.P., K.H.P., is appointed Director of Medical Services, Air Ministry (March 1) vice A.V.-M. J. McIntyre, C.B., M.C., M.B., B.Ch. A.V.-M. J. McIntyre, C.B., M.C., M.B., B.Ch., K.H.S., is placed on the retired list at his own request (March 1). Flt. Lt. R. L. Raymond, M.B., Ch.M., F.R.C.S. (E), relinquishes his short service commission on transfer to the Indian Medical Service (Jan. 25); subsituted for the notification in the *Gazette* of Jan. 29.

ROYAL AIR FORCE RESERVE

Reserve of Air Force Officers

General Duties Branch

F/O. A. E. V. Mathias is transferred from class A to class C (Aug. 18, 1934).

The following Flying Officers relinquish their commissions on completion of service:—L. H. Mason (Sept. 26, 1934); C. D. G. Welch (Jan. 6).

The notification in the *Gazette* of Dec. 18, 1934, concerning F/O. Colin Arthur Anderson is cancelled.

AUXILIARY AIR FORCE

General Duties Branch

No. 601 (COUNTY OF LONDON) (FIGHTER) SQUADRON.—P/O. A. C. W. Norman is promoted to the rank of Flying Officer (Jan. 25).

No. 603 (CITY OF EDINBURGH) (BOMBER) SQUADRON.—P/O. A. J. Deas resigns his commission (June 25, 1934).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Wing Commanders.—E. B. Rice, to No. 1 Armament Training Camp, Catfoss, 25.2.35; to command. J. M. Robb, D.S.O., D.F.C., to Headquarters, R.A.F., Mediterranean, 12.2.35; for duty as Fleet Aviation Officer to Commander-in-Chief, Mediterranean Fleet vice Group Capt. F. G. D. Hards, D.S.O., D.F.C.

Squadron Leader.—R. Harrison, D.F.C., to R.A.F. Depot, Middle East, Aboukir, 22.2.35; for duty as Station Adjutant vice Sqn. Ldr. W. H. Poole. C. B. S. Spackman, D.F.C., to Headquarters, R.A.F., Middle East, Cairo, 2.3.35; for Air Staff Intelligence duties vice Wing Cdr. H. G. Bowen, M.B.E.

Flight Lieutenants.—R. H. W. Empson, to R.A.F. Base, Calshot, 24.2.35. J. B. Knapp, to Aeroplane & Armament Experimental Establishment, Martlesham Heath, 25.2.35. M. C. Pascoe, to No. 201 (F.B.) Squadron, Calshot, 25.2.35. E. F. Thorpe, to Reception Depot, West Drayton, 25.2.35. W. V. L. Spendlove, to No. 608 (N. Riding) (B) Squadron, Thornaby, 26.2.35. L. de V. Chisman, to No. 31 (Army Co-operation) Squadron, Quetta, India, 28.2.35. F. G. H. Ewens, to No. 11 (B) Squadron, Risalpur, India, 28.2.35. G. H. H. Procter, to Aircraft Depot, India, Karachi, 28.2.35. B. H. C. Russell, to Special Duty List, 1.3.35; for duty with the Army on appointment as G.S.O. III, Salisbury Plain Area. W. A. B. Savile, to No. 3 Flying Training School, Grantham, 1.3.35.

Flying Officers.—H. R. Dale, to Central Flying School, Wittering, 24.2.35. A. S. Q. Robins, to No. 39 (B) Squadron, Risalpur, India, 28.2.35. O. A. Morris, to No. 501 (City of Bristol) (B) Squadron, Filton, 28.2.35. F. A. J. Pollock-Gore, to No. 501 (City of Bristol) (B) Squadron, Filton, 27.2.35.

Pilot Officers.—W. E. Carr, A. D. Groom, and H. V. Hoskins, to R.A.F. Depot, Uxbridge, 19.2.35. On appointment to Short Service Commissions. G. H. Foss, P. E. Hadow, and P. B. B. Ogilvie, to Royal Air Force College, 28.2.35. C. H. Bradon, to No. 203 (F.B.) Squadron, Basrah, Iraq, 22.2.35. G. C. Eveleigh, to No. 802 (F.F.) Squadron, Netheravon, 1.3.35. R. J. Burrough, to No. 31 (Army Co-operation) Squadron, Quetta, India, 28.2.35. R. C. F. Lister, to No. 20 (Army Co-operation) Squadron, Peshawar, India, 28.2.35. D. Saward, to No. 31 (Army Co-operation) Squadron, Quetta, India, 28.2.35. D. G. Stokes, to No. 31 (Army Co-operation) Squadron, Quetta, India, 28.2.35. C. L. Y. Wright, to No. 20 (Army Co-operation) Squadron, Peshawar, India, 28.2.35.

Acting Pilot Officers.—C. N. Fleming, to No. 30 (B) Squadron, Mosul, Iraq, 6.2.35. G. J. Bush, to No. 4 Flying Training School, Abu Sueir, Egypt, 21.2.35. V. N. Clifton, to No. 1 Armoured Car Company, Hinaidi, Iraq. 22.2.35.

Commissioned Engineer Officer

Flying Officer.—D. H. Newton, M.B.E., to Aircraft Depot, India, Karachi, 28.2.35.

Stores Branch

Flight Lieutenant.—C. W. H. Molier, to Station Headquarters, Pembroke, 2.3.35.

Flying Officers.—J. W. C. Revill, to Reception Depot, West Drayton, 22.2.35. J. E. V. Tyzack, to No. 35 (B) Squadron, Bircham Newton, 11.3.35. W. A. Lee, to No. 20 (Army Co-operation) Squadron, Peshawar, India, 2.2.35.

Accountant Branch

Flying Officer.—D. Lumgair, to No. 8 (B) Squadron, Aden, 22.2.35.

Medical Branch

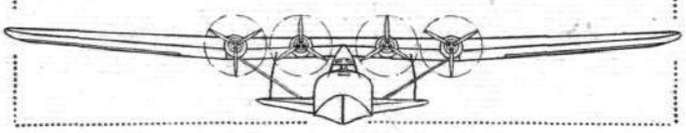
Squadron Leaders.—T. J. D. Atteridge, to Headquarters, Coastal Area, Lee-on-the-Solent, 1.3.35; for duty as Deputy Principal Medical Officer vice Sqn. Ldr. T. J. X. Canton. W. E. Barnes, to R.A.F. Hospital, Cranwell, 1.3.35; for duty as Medical Officer.

Flight Lieutenants.—J. Kemp, to Princess Mary's R.A.F. Hospital, Halton, 25.2.35. J. McGovern, to Aircraft Depot, Iraq, Hinaidi, 1.2.35. O. M. Fraser, to No. 3 Armament Training Camp, Sutton Bridge, 1.3.35.

Flying Officer.—G. H. Morley, to No. 1 Armament Camp, Catfoss, 1.3.35.

FLYING-BOATS of 134 TONS?

No Size Limit in Sight : Structure Weight can be Kept Down : A Well-known Designer's Significant Views



A FASCINATING glimpse of the future was afforded members of the North-East Coast Institution of Shipbuilders and Engineers in the paper read to them last Friday by Mr. Arthur Gouge, whose subject was "Flying-boats and their Possible Development." Mr. Gouge is, as most *Flight* readers will know, general manager of Short Brothers, and, as he was chief designer of that firm before becoming general manager, his views obviously carry a very great deal of weight, backed as they are by many years of experience in the design and construction of flying-boats. Thus, when Mr. Gouge speaks of the future, one may be sure that the opinions he expresses were formed on solid facts and not on problematical surmises and assumptions.

After tracing briefly the development of flying-boats since their inception—for which, incidentally, he gave full credit to the Curtiss Company of America—the lecturer discussed the water characteristics of present-day hulls, and showed typical curves of resistance, attitude and the effect of applied moments for a flying-boat of about 40,000 lb. weight. Engines were also dealt with briefly, and Mr. Gouge gave his reasons for believing that the petrol engine will hold its own against the compression-ignition engine for some time to come.

Turning his attention to the subject of what we may reasonably expect in the not too distant future, Mr. Gouge examined the main factors which affect flying-boat size. As this part of his paper was of unusual interest, we give it in full.

A Practical Giant

At the present moment it should be possible to start the design and construction of a flying-boat to be produced, say, in the year 1937 or 1938 weighing approximately 220,000 lb. This prediction is, of course, based entirely on what has been done in the past, and while this method of prediction is very sound as regards the total all-up weight, it gives no indication whatever how this total weight is made up, and it is conceivable that while you can build a flying-boat weighing 220,000 lb., or even more, it is possible that all the weight would be expended in building the hull, wings, etc., and in installing the engines, leaving nothing at all for load or range. It is necessary, therefore, before assuming that the larger boat predicted from the curve of growth is a boat of practical application and not just a theoretical conception, that we attempt to analyse the component parts with particular regard to weight.

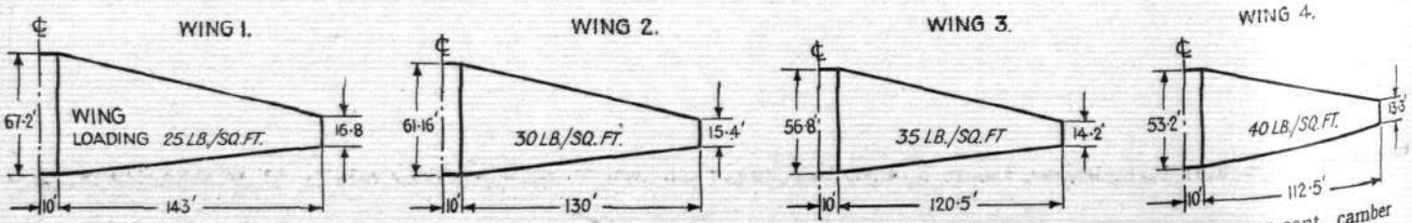
Considering first the question of the hull for boats of varying all-up weight, it is easily proved that the beam of a flying-boat hull varies directly as the cube root of the total weight. Also, within small errors the fore-body and after-body planing surfaces vary in the same manner. If, therefore, one can assume that the depth of the hull and the top-side width of the hull are proportional to the beam (this assumption is, in general, a good approximation, but not necessarily strictly true), the surface areas of similar boats are proportional to the ratio of the total weights to the two-thirds power. The weights of similar flying-boat hulls will, therefore, be proportional to the ratio of total weights to the two-thirds power multiplied by some quantity which represents the skin thickness of the hull, when the skin thickness is taken to include any frames or stiffeners.

If one now considers the stresses set up in the skin of the hull due to, say, a special landing case, that is, hitting the water surface at a fine angle, it is easy to arrive at a variation of this quantity which I have called skin thickness for similar hulls. This thickness is found to vary in the ratio of total weight to the two-thirds power; therefore, around the centre section of the hull the weight of the hull will vary as the ratio of the total weights to the four-thirds. This is always assuming that no greater stresses can be developed in the thick-skinned large hull than on the thin-skinned small hull. Actually, of course, a greater skin stress can be developed with the thicker plates; therefore, although theoretical considerations lead to the conclusion that the weight of centre sections of flying-boat hulls varies as the all-up weight to the four-thirds, the actual increase in weight will be less than indicated here for the reason mentioned above.

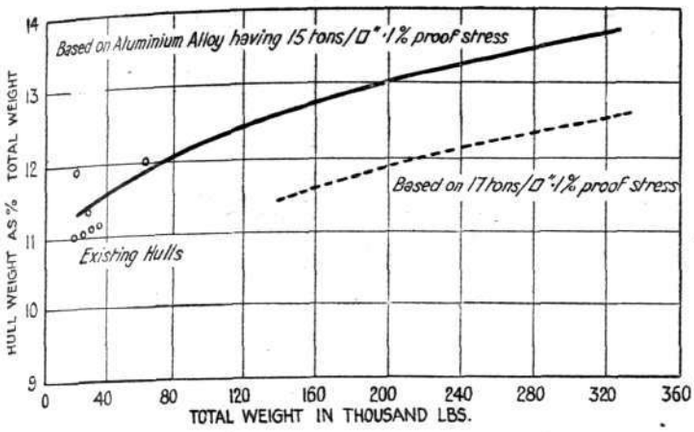
Component Weights

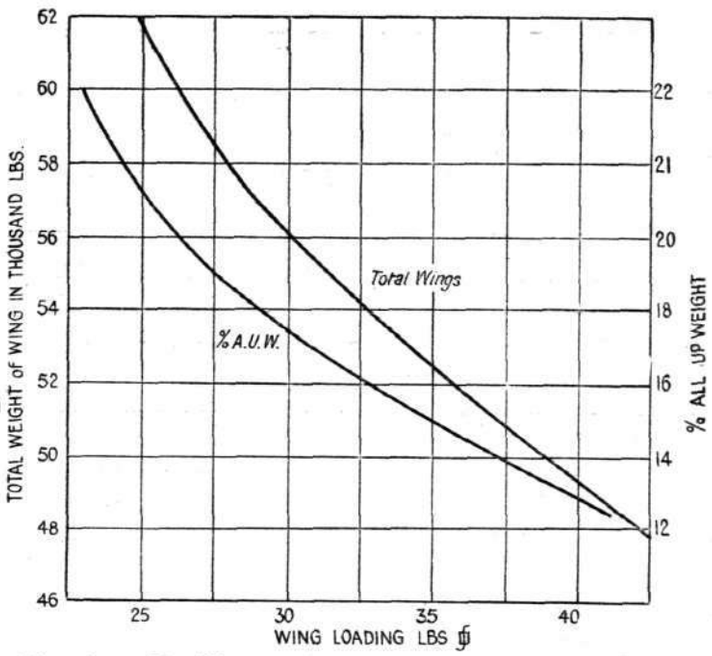
For the purposes of this Paper I propose to assume that it is required to design a flying-boat of, say, 300,000 lb. all-up weight, and the remainder of the Paper will be an attempt to forecast the weights of the various components and what could be reasonably expected from such a boat in the way of performance and pay load. For the hull there is no doubt that the centre portion will increase in weight slightly less than that given by the ratio of the total weights to the four-thirds power, and this ratio will hold over about half the area of a flying-boat hull surface. The other half of the surface area will probably not need increasing in thickness over the thicknesses existing on present-size hulls where the skin thicknesses are determined more from practical considerations than by any calculated stresses. If the above assumption can be considered reasonable, and I am of the opinion that it is, then it can easily be seen that the weight of the hull for a flying-boat of 300,000 lb. weight will be in the neighbourhood of 13½ per cent. of the total all-up weight, as compared with about 12 per cent. for a boat weighing 60,000 lb.

One of the graphs shows the percentage weight of a bare hull plotted against the all-up weight for boats of which I have personal knowledge, and while these ranges and weights are limited to an all-up weight of 68,000 lb., I am of the opinion that the extrapolation of this curve to heavier boats is not an under-estimation of the hull weight. The weights of existing flying-boat hulls and the extrapolation therefrom are based on the use of aluminium alloy material throughout the construction of the hull, both for skin sheeting and for structural members. This material has a 0.1 per cent. proof stress of 15 tons/sq. in. At the present time it is possible to obtain aluminium alloy with a 0.1 per cent. proof stress of 17 tons per sq in. having corrosion-resisting properties equal to that of the lower strength material. The dotted line shows the estimated weights of large flying-boat hulls using this



Plan form of wings for various wing loadings. All wings have a 20 per cent. camber at the root and a 10 per cent. camber at the tip.





Weight of bare hull as percentage of all-up weight. (Right) Variation of wing weight with wing loading.

better quality of aluminium alloy. It will be seen that a gain of over 10 per cent. in weight is made by the use of this better-quality material. It can, therefore, be stated with some confidence that the weight of a flying-boat hull for a machine weighing 300,000 lb. would be in the neighbourhood of 12½ per cent. of the total weight. In estimating the saving in weight due to the using of better-class material account has only been taken of that part of the hull structure whose weight varies as the total weight to the four-thirds power.

Having dealt briefly with the question of hull weights for a machine weighing 300,000 lb., the next item which requires serious consideration is that of the wings. For the wings considered it will be assumed that they are of the cantilever type, with the power units mounted in the wings. The fuel is also accommodated in the wings. Theoretical work has shown that the spar weight is directly proportional to the wing span cubed, to the wing loading, to the density of the material used, and, also, as a complicated function of the geometrical form of the wings. In addition, it will be seen that the weight is inversely proportional to the amount of allowable stress. For the purpose of this Paper an example has been taken where the plan form is assumed to be a straight taper, the chord of the wing at the root being four times the chord of the wing at the wing tips, the depth of the wing being decided by a 20 per cent. camber ratio at the root and a 10 per cent. camber ratio at the tip. Also, an aspect ratio of 7 has been used, where the aspect ratio is defined as the span² ÷ area, the span being the total distance from wing tip to wing tip, and the area being total area, including that part of the wing which passes through the body. The body is assumed to have a constant width of twenty feet.

Calculations of weight have been made, using the foregoing wing geometry for wing loadings of 25, 30, 35 and 40 lb. per sq. ft. A diagram shows the plan form of these wings to the same scale. A load factor of five is used in all cases. The allowable intensity of stress has been assumed to be 50,000 lb. per square inch in tension and 30,000 lb. per square inch in compression, and the material used is an aluminium alloy having a relative density of 2.85.

1	2	3	4	5	6	7	8	9	10	11
Wing	Loading lb./sq. ft.	Relieving Load lb./sq. ft.	Boom Wt. lb.	Shear Wt. lb.	Joints, etc. lb.	Spars Wt. lb.	Extra to Spars lb.	Total Wings lb.	Wt. of Wing lb./sq. ft.	Wings per cent. of Total Wt.
1	25	8	18,340	10,680	5,800	34,800	27,000	61,800	5.15	20.6%
2	30	8.75	16,720	10,100	5,364	32,200	24,000	56,200	5.62	18.7%
3	35	9.5	15,950	9,620	5,114	30,680	21,800	52,480	6.10	17.5%
4	40	10.25	15,100	9,200	4,860	29,160	20,100	49,260	6.57	16.4%

The above shows the results of the weight calculations for these wings. Columns 1 and 2 of this table need no explanation. Column 3 shows the weight in lb. per square ft., which has been allowed as the relieving load on the wings due to the weight of the wings themselves plus engine and fuel weight. Actually the relieving load taken is much less than that which actually occurs, but as the calculations assume that the relieving load is spread uniformly over the wing, the figures given in this table are good enough for the case under consideration. It will be noticed that a greater relieving load in lb. per sq. ft. has been taken as the wing loading increases. This is due to the fact that the relieving load is the sum of the weight of the wings, plus the other load which is in the wings. This other load is practically independent of wing area and is nearly a constant amount. In column 4 will be found the calculated weight of the top and bottom booms of the spar, which requires no further explanation. Column 5 gives the calculated weight of the shear bracing, plus the drag bracing in the fore and aft direction. For the purpose of this table it has been assumed that the drag bracing is the same weight as the vertical shear bracing. In column 6 is an item which has been added to the calculations to allow for joints and for the fact that in some cases it is not practicable to design the spar right down to the calculated sizes. This, in all cases, has been taken as 20 per cent. of the sum of the boom weights plus the shear weights. Column 7 gives the estimated total spar weight, being the summation of the previous columns. Column 8 is an estimation of the additional weight of the wings other than spar weight. This, as will be noticed, is a very large item and is the item most open to question. The assumption made to obtain these weights is that the extra to spar weight in the case of Wing (1) is 2.25 lb. per sq. ft., Wing (2) 2.4 lb. per sq. ft., Wing (3) 2.55 lb. per sq. ft., and Wing (4) 2.7 lb. per sq. ft.

Heavy Wing-loading

Column 9 is the estimated total weight of the wings. Column 10 is the estimated weight of the wings in lb. per sq. ft. Column 11 gives the weight of the various wings as a percentage of the total machine weight. The weight of a cantilever wing for a small flying-boat of, say, 40,000 lb., all-up weight, would be in the neighbourhood of 13-14 per cent. of the total all-up weight for a wing loading of 25 lb. per sq. ft. (some modern American boats are better than this)—so it will be seen that it is essential at the present time for the large flying-boat to have a much heavier wing loading, probably approximating to 40 lb. per sq. ft. It would appear, therefore, that the wing weight as a percentage of the total weight is 2 or 3 per cent. greater than on the smaller boat.

Another graph shows the calculated variation of wing weight with wing loading. It is interesting, however, to note that a material 20 per cent. better than the material used in these calculations would result in the wings of the larger boat at 40 lb. per sq. ft. being the same percentage of the total weight as with the smaller boat. This high wing loading naturally results in fast landing and take-off speeds, and it becomes essential to fit flaps or a similar device in order to reduce these speeds to the absolute minimum. Variable pitch airscrews are also necessary, not only to improve the efficiency of the screws themselves due to the possibility of reducing the pitch angle, but also to take advantage of the extra power which is permitted for take-off purposes.

It will be seen that the sum of the wing hull weights for the flying-boat under consideration amounts to 29 per cent. of the total weight. The remainder of the structure which in-

(*Continued on page* 288.)

PRIVATE FLYING

Towards Melbourne

CAUGHT BY LOW CLOUDS AND DARKNESS ON THE LAST STAGE OF HIS FLIGHT TO MELBOURNE, LORD SEMPILL MAKES A FORCED LANDING ON THE BEACH

THE few hours I spent in Alice Springs gave me a foretaste of Australian hospitality. Although landing grounds have been laid down at intervals along the route I followed, which are maintained by the Government, it is not one which is frequently followed in making the journey from the North to the main cities of the South.

There are as yet few centres of development which would justify a regular air line through this region, although it would shorten the journey from Darwin to Adelaide and Melbourne. Alice Springs is served by a railway running from the South. The town itself lies in the midst of the pastoral areas of Central Australia, where the chief industry is cattle raising, and from here the live beasts are entrained for the abattoirs of Adelaide and other South Australian towns.

As usual, I had no difficulty with petrol supplies, and I refuelled my machine in readiness for an early morning start. Before turning in I asked the petrol man to call me at 4 a.m., but I had not been in bed long when he awakened me to inform me that the wind was rising, and that he thought the machine should be pegged down. This we did, and I again retired. He had been very attentive and helpful in every way, and it was not altogether surprising that he failed to call me at the appointed time. I managed to wake, however, and was ready with my luggage to leave for the aerodrome at 5 a.m. As he had not arrived to pick me up, I went out in the village with a view to finding the car we had used to drive in from the landing ground on the previous day. I soon discovered what I thought was the one, and drove off to the aerodrome to get the machine ready. Soon afterwards the petrol man drove up, and I learnt that the car I had stolen was not his but the Chief Constable's. When, later, I made an all-Australian broadcast, I apologised for the error.

Dust at 5,000 ft.

THERE had been a little rain in the night, but it was fine when I started, and I was able to get off with a full load. I wanted to make the journey from Alice Springs to Melbourne in the day, and this involved flying between thirteen hundred and fourteen hundred miles. The course lay *via* Adelaide, and I made good progress to Farina, which lies to the south of Lake Eyre, and landed there to refuel, having flown 550 miles. The people there were very interested in an English visitor, and I was entertained by the postmaster and his wife. The latter brought me some hot coffee and sandwiches, for which I was very grateful, as before starting out in the morning I had had only three raw eggs and some cold coffee. I was anxious to push on, and lost no time in starting on the next stage—350 miles to Adelaide. I had not been flying long when I ran into a dust-storm. This, in places, rose to 5,000 feet, and it was not until I had flown nearly fifty miles that I passed through it. The fine red dust then gave place to rain, and the visibility was poor for some time. Conditions improved, however, and I reached Adelaide at about 4.30.

The route followed on the previous stages was by the great salt lakes. These salt lakes are frequently found in this part of Australia, and some of the more shallow ones dry out, and the bed then makes a good landing place. The salt-pans, as they are called, are visible for miles, and make very good landmarks.

The aerodrome at Parafield (Adelaide) is excellent. It has a level surface, which makes a satisfactory landing ground in all weathers, and provides a take-off of 900 yards from north to south, and 800 yards from east to west. There are high-tension wires on the east and telegraph wires on the west, but these are easily avoided. The Government have done a good deal in the last few years to improve the main aerodromes, and Adelaide is one of the best. On arrival, I was very kindly received and was pressed to stay, but I had made up my mind to reach Melbourne if possible. It was after 5 p.m. when I had refuelled, but I hoped to reach Melbourne—a further 400 miles before it was really dark.

After Dark

FOR some time the weather was good, although cloudy. The clouds becoming lower, I turned southwards and made for the coastline in order to avoid the hills. I then followed the coast northwards in the direction of Melbourne, and once again I was frustrated. What would have been a perfectly simple flight in reasonable weather conditions proved impossible in the circumstances which developed. Although I knew the general direction of the aerodrome, the clouds were so thick that I could not locate it, and, as it had by now become quite dark, I saw that I must go back where there were fewer clouds and try to make a landing. Placed as I was, I could not help wishing I had with me some of the very efficient parachute flares I had been testing out a few months before embarking on this flight. However, I had to get down with nothing better than the illumination from my navigation lights.

I found the coast again, and, after flying for some time, came into a clearer patch with the moon showing occasionally through the clouds. With the aid of this meagre light, and guided by the surf line, I was able to keep clear of the cliffs, and eventually found a good but narrow sandy beach on which I decided to come down. I took two or three glances at it before actually coming in to land, in order to see whether it was clear of rocks. This survey being satisfactory, I landed with one wheel in the surf but with the wing clear of the steeply rising beach. Luckily the landing was a good one, although I was pulled up rather sharply by the soft sand. For the same reason the machine was immovable without help, and I was very glad that the tide appeared to be fully up. As it was, an occasional wave just lapped the port elevator, which, fortunately, was the only part damaged, although, of course, the machine was drenched in spray.

Through the Bush

IT was about 11 p.m., and, as I could not move the machine myself, I decided to make inland through the bush in the hope of finding someone who could help me to set the machine higher up the beach. I found the next morning that I could have used a track which led through the scrub close to where the machine lay. Not being aware of this, I struggled through the almost impenetrable undergrowth, and at last found some houses. By this time, however, everyone was fast asleep in bed, and I was loath to disturb them. I returned to the beach, therefore, and stood by the machine until dawn.

FROM THE CLUBS

Events and Activity at the Clubs and Schools

DUBLIN

On account of bad weather, only 65 hours' flying has been recorded by Dublin Air Ferries, Ltd., during the past month. There are seven new members, including Lady Nelson. A line squall and a sudden fog featured in the flights of two pupils, happily resulting in no damage.

MIDLAND

Air Ministry approval for blind flying instruction has been granted to the Midland Aero Club.

Flying times for the week ended March 7 were: 11 hr. 5 min. dual, and 11 hr. 40 min. solo. Miss B. Franks and Mr. P. Dawes passed their "A" licence tests. The monthly dance, which took place on Saturday last, was, as usual, very popular.

HATFIELD

During the week Flt. Lt. S. C. O'Grady, Flt. Lt. H. W. St. John, P/O C. C. Hyar and Capt. E. W. Walford became members of the Royal Air Force Flying Club.

The London Aeroplane Club recorded 55¼ hours' flying time last week. New members of the Club are Messrs. R. H. Pilcher and D. Shepherd.

YORKSHIRE

About ten hours were flown on Club aircraft last week, two flights being made to Brough and back. Mr. F. Ten Bos, from Holland, visited the Club in his "Puss Moth." The Aviation Group Scheme, intended to enable young people of limited means to pay for tuition by instalments, has "caught on," and one or two subscribers are already taking courses.

KENT

A British Klemm was demonstrated to members at Bekesbourne on Saturday. The Club, of course, is already "monoplane-minded," as 90 per cent. of the flying is done on "Hawks."

Flying time for the fortnight ended March 10 amounted to thirty hours. Mr. Coleman passed the tests for his instructor's licence. An interesting day was spent by several members at the Short works at Rochester on March 4.

HANWORTH

Baron Baner, who recently made his first solo, has bought a "Moth" on which he intends to complete the necessary time for his "B" licence. Two other members recently made first solos, one passed his "A" licence tests, and another renewed his "A" licence. Flying time for the week amounted to 38 hr. 25 min.

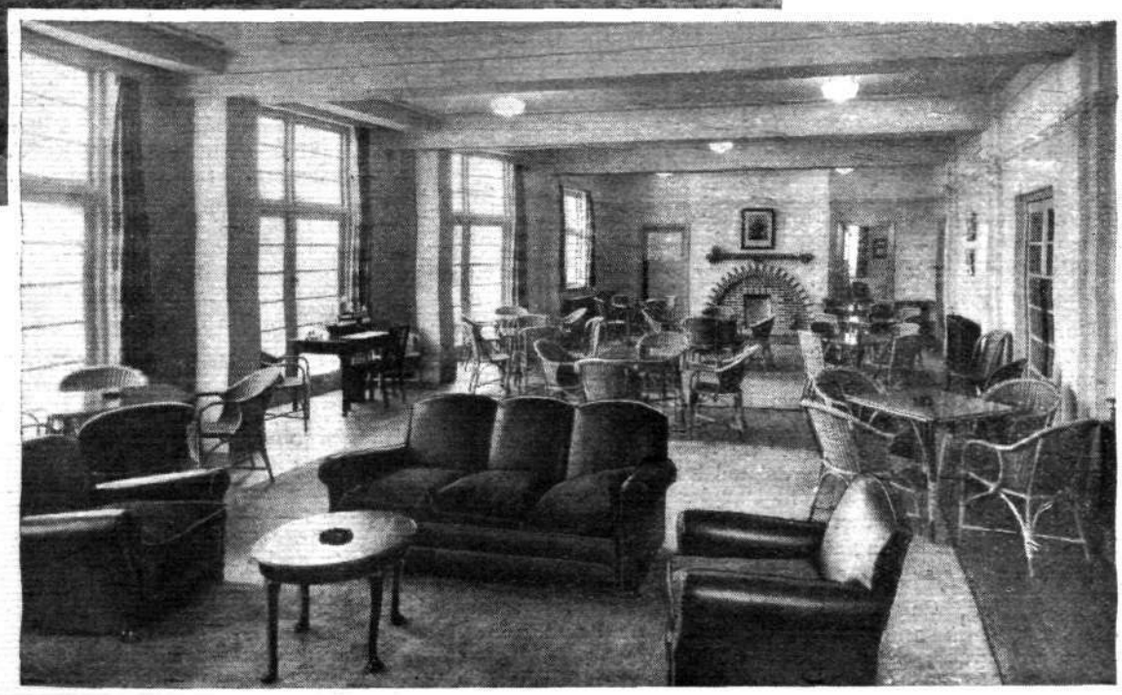
NORFOLK AND NORWICH

Last week Mr. Frederick Low, the club's aerial photographer, gave a talk to interested members of the "Round Table." During the week-end F/O. A. J. S. Morris flew with a passenger to Baldonnel. There were seven soloists last week. On Wednesday Mr. George Gregory gave a demonstration of films, most of them being of aeronautical interest.

AIR SERVICE TRAINING

No less than 500 hours' flying were recorded at A.S.T. during February. This is almost double the flying time for the same month last year, and indicates how rapidly this "Air University" is expanding. During the month two more Avro "Cadets" have been added to the school fleet, bringing the strength of this one type of aircraft up to fifteen. The construction of a new block of living quarters, it is hoped, will be completed in May.

Examination results for the past month were quite gratifying. Five students have obtained the P.M.G.'s W/T air operators' licences, one has qualified for his "A" licence, and one for his "B" licence. One has obtained his second-class navigator's licence, two have completed blind flying courses and have qualified for the A.S.T. blind flying certificate, and two have completed flying instructors' courses, both being categorised A.S.T. "B." Mr. E. R. B. White, of Imperial Airways, is taking a special instrument flying course and is working for the first-class navigator's licence. Messrs. Dastur and Gazdar have completed courses at the school and have left for India in their "Hawk Major." Mr. A. F. C. Booth, R.A.F.O., has completed his course and has been appointed a first officer with Imperial Airways.



COMFORT AND UTILITY: Interior and exterior views of the clubhouse buildings on the new Leicester aerodrome. The Leicestershire Aero Club is already in residence and, as can be imagined, the members are satisfied with their quarters. On the top of the clubhouse is the Chance shadow-bar floodlight for night landings—Leicester is, incidentally, now on a regular air route between Hull and Plymouth.

Private Flying

BROOKLANDS

Mr. Vriesendorp, who came over from Holland to learn to fly, has passed his "A" licence tests, and so has Mr. Fox. New members last week included Messrs. Bonner, Jeffers, Sprigg, Dobell and Hyde-Jones. Mr. Downing flew his "Leopard Moth" to Paris and back on Thursday. Mr. Tommy Rose also gave a demonstration of the Miles "Hawk Major," and Mr. Aga has now taken delivery of one of these machines.

HERTS AND ESSEX

Strong winds have hampered flying during the past week, but in spite of these a high average has been maintained, flying time amounting to: Dual 24 hr., and solo 27 hr.

The Alexander Clark Competition was held last Sunday. The competition took the form of a spot landing contest, and the number of entries constituted a record for the club. Mr. W. J. Groom presented the prizes to the winners in the absence of Mr. V. Clark. The contest was a very close one, and the results were: 1, E. L. Gay; 2, J. A. Macdonald; and 3, B. F. Collins.

CINQUE PORTS

Weather during the early part of the week was fair and flying times for the whole week increased to 28 hours as a result. Mr. J. E. H. Sayers has joined the club, and Mrs. MacDonald has acquired a very smart "Hawk Major," which she is housing at Lympne.

Applications for tickets for the dinner and dance are coming in fast. On March 16 Mr. Ken Waller is starting a holiday cruise with Capt. Duncan Davis. Mr. D. Rea, from Hatfield, will act as assistant instructor during the absence of Mr. Waller.

LIVERPOOL

Fog and rain seriously hampered flying last week-end, but during the week 31 hr. 25 min. flying was recorded. The second informal dance and treasure-hunt will take place in and from the Hooton clubhouse on Saturday, March 16, commencing at 5.45 p.m. At 12 noon on Saturday, March 23, a skeleton map-reading competition will be held. The winner will be awarded a silver cup, to be held for one year.

It has been decided that, with effect from March 12, the closing day for the clubhouse at Hooton will be Tuesday instead of Monday. The closing day at Speke continues to be Monday.

COVENTRY

The Coventry Aviation Group reports a very successful year. During the last twelve months forty-eight flying members, eleven gliding members, and ten associate members have enrolled; the last class has only recently been opened. The club has purchased an "Avian" ("Genet") for instructional purposes, and is very pleased with its performance. The machine was christened *Godiva* by the Mayoress of Coventry, and Capt. W. F. Strickland, the local M.P., took the first flight. A number of owner-pilots came over from neighbouring clubs for the ceremony. [We hear that one of the pilots recently landed this machine "where the aerodrome wasn't" and wrote off the undercarriage. Hard luck for a new club.—ED.] The Mayor of Coventry, incidentally, has been elected president for the forthcoming year. A piece of land has been rented at the entrance to Whitley aerodrome, and the members are erecting a hangar in their spare time.

WITNEY AND OXFORD

For the past fortnight flying time totalled only 6 hr. 20 min. due to stormy weather and the inability of Mr. J. D. Rose, the new instructor, to take over his duties until March 5. Mr. Rose has had considerable experience as an instructor in the R.A.F. and holds a C.F.S. "A" category and second-class navigator's licence.

CAMBRIDGE

Fourteen members of the Civil Aviation Corps flew on Sunday. Flying times amounted to 29 hr. 55 min. dual and 21 hr. 45 min. solo. Miss M. Marshall made her first solo, and Mr. T. Gay passed his "A" licence tests. Four other members have passed their flying tests and have only to be examined on their "oral."

NORTHAMPTONSHIRE

On Saturday, March 9, the Guildhall at Northampton was filled with those attending the annual dinner of the Northamptonshire Aero Club. Guildhalls and town halls are, more often than not, barrack-like places with many draughts, much mustiness, and a forbiddingly gloomy interior; that at Northampton possesses none of these characteristics. It is cheerful, interestingly decorated with evidences of past glories of the county, and altogether a suitable place in which to prove to the Mayor and his Corporation that in the air lies the path to further glories. As a matter of fact, the Mayor (Ald. A. Burrows) does not need to be convinced that this is the case. After having been introduced by Capt. Duncan Davis, who in the course of a commendably brief speech proposed a toast to "Northampton Town and County," his Worship, although admitting that he had not yet been up in the air, said that in their view the purpose of a flying club was to provide fast transport for the country and their own town in particular, and that it was their duty to see that Northampton was not behind others. [Perhaps before our next visit the name of Sywell will be changed to that of the Northampton and District Municipal Airport.—ED.]

The guests of the evening were Messrs. Charles Scott and Ken Waller, and their health was proposed by Mr. C. M. Newton. In the course of their replies, Mr. Scott pointed out that the commercial side of flying was likely to be more important that the military, and that flying clubs formed a nucleus of pilots from which potential commercial pilots could be drawn. Mr. Waller said that he had chased Scott over most of the earth's surface, and this was the first time he had caught up with him!

Lt. Cdr. C. N. Colson, of *Flight*, asked those present to drink to the future prosperity of the club. He drew attention to the record held by the club for interesting and well-run flying meetings, and suggested that the number of active flying members, which was now 100, should be increased by a general drive. He asked that the toast be coupled with the names of the president of the club, Lord Willoughby de Broke, and the chairman, Capt. G. R. D. Shaw.

The president, in reply, hoped that Northampton would become fully alive to the need for a municipal airport, and that they would not, as had so many towns during the railway development, be left "off the map." He thought that the time had come when investors would be interested in airport schemes. Capt. Shaw thanked *Flight* for the help they had always given to flying clubs, and pointed out that statistics show flying to be much safer than motoring.

The Prince's New Machine

A specially equipped D.H. 89 ("Rapide") has been chosen by the Prince of Wales for his personal transport during 1935. The Vickers "Viastra" and the D.H. "Dragon" previously owned by him have been or are being sold.

Training in China

During February thirty students from the Kwangsi Government were taking a long engineering course, and six officers from the Central Government, Nanking, were taking "B" licence courses at the Far East Flying Training School, Ltd., Kai Tak aerodrome, Hong Kong. This school is operated by the Far East Aviation Co., and the Commandant is Mr. W. F. Murray, who will shortly be assisted by Flt. Lt. P. H. Smith, in succession to Lord Malcolm Douglas Hamilton.

In spite of strong American and Italian competition, British interests are still having some say in Chinese aviation.

Misr Airwork Schools During 1934

At Almaza, Cairo and Dekheila (Alexandria) totals of 984 hr. 35 min. and 1,246 hr. 20 min., dual and solo, were flown and twenty-three "A" licences and two "B" licences obtained. Mr. A. D. Carrol is chief instructor and Sabr. Kashef Effendi assistant instructor at Almaza, and Mr. E. G. Parsons is instructor at Dekheila. Mr. Carrol has now completely recovered from the effects of his accident.

On February 8 the new aerodrome at Assiut was officially opened, and a flying school will be started there under Misr Airwork in the near future. Mr. Carroll, the Chief Instructor of the Cairo School, gave an aerobatic display, and several notable people arrived for the opening ceremony.

Mudguards and Landing Lights

The D.H. "Leopard Moth" ordered for the Airwork School of Flying was delivered last week. This cabin trainer is now undergoing small modifications to fit it for school work. One of these is the addition of mudguards to the wheels. As mud is the foundation of most British aerodromes, a fuselage with a low ground clearance becomes plastered with it very quickly. Spats are not easily detached, and in a flying school accessibility and quick service are essential, so the lighter mudguard is to be used.

Navigation lights are already fitted to this machine, and an unusual addition is a landing light, now being installed. Prospective owners will thus be able to become accustomed to it in a dual control machine.

A NEW AUTOMATIC PILOT

P.B. Automatic Control Now Available in Three-axes Form : Interesting System of Rotor Mounting

THE production of an entirely "free" gyroscope, that is, one which is hung in universal gimbals with frictionless pivots and perfect balance, is an extremely difficult matter. Friction causes torques to be set up about each axis, with the result that the rotor axis wanders at right-angles to it.

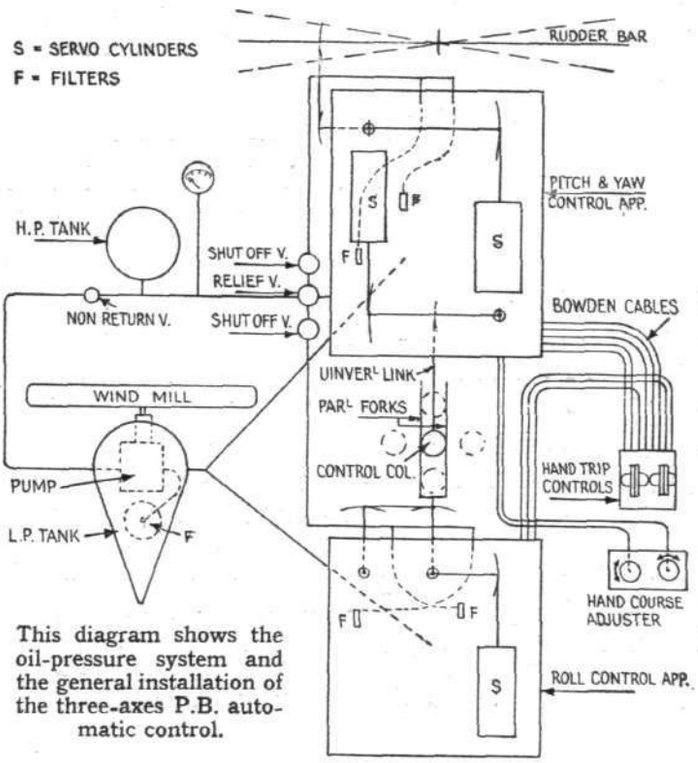
Furthermore, a "free" gyroscope will tend to maintain its axis of spin in "space," whereas it must be co-related with the earth by gravitational precessions on both axes, and this, unfortunately, can only be arranged for at any one latitude. Thus this type of gyroscope must be super-controlled against wander and for the earth's movement by, say, a magnetic compass for azimuth, and a balance weight or air-speed pressure device for pitch, with all the attendant troubles.

The P.B. automatic control, named after its inventor, Mr. Pollock Brown, whose "Deviator" was described in *Flight* of February 27, 1931, does not depend for its accuracy on a "free" type of gyroscope. The rotor is mounted about its centre of gravity on a ball, so that unrestricted movement is allowed in all directions. That is to say, the central web of the wheel is provided with cup bearings to fit a ball which is attached to the end of a shaft terminating in a Pelton wheel, which is driven by a jet of oil at about 50 lb./sq. in. pressure.

It will be seen, therefore, that there is no direct drive to the gyro wheel, but merely transmission by friction between the ball and the cup; when spinning, the wheel is virtually sitting on a film of oil surrounding this ball.

Displacement of the wheel sets up a torque by virtue of the different planes of rotation of the ball and the surrounding cup, and this torque, acting as it does equally around the whole circumference of the cup, exerts a righting moment which brings the axis of the wheel back into line with the axis of the shaft carrying the ball. Wander is, therefore, virtually impossible; this seeming insensitivity correlates its axis and the earth's motion.

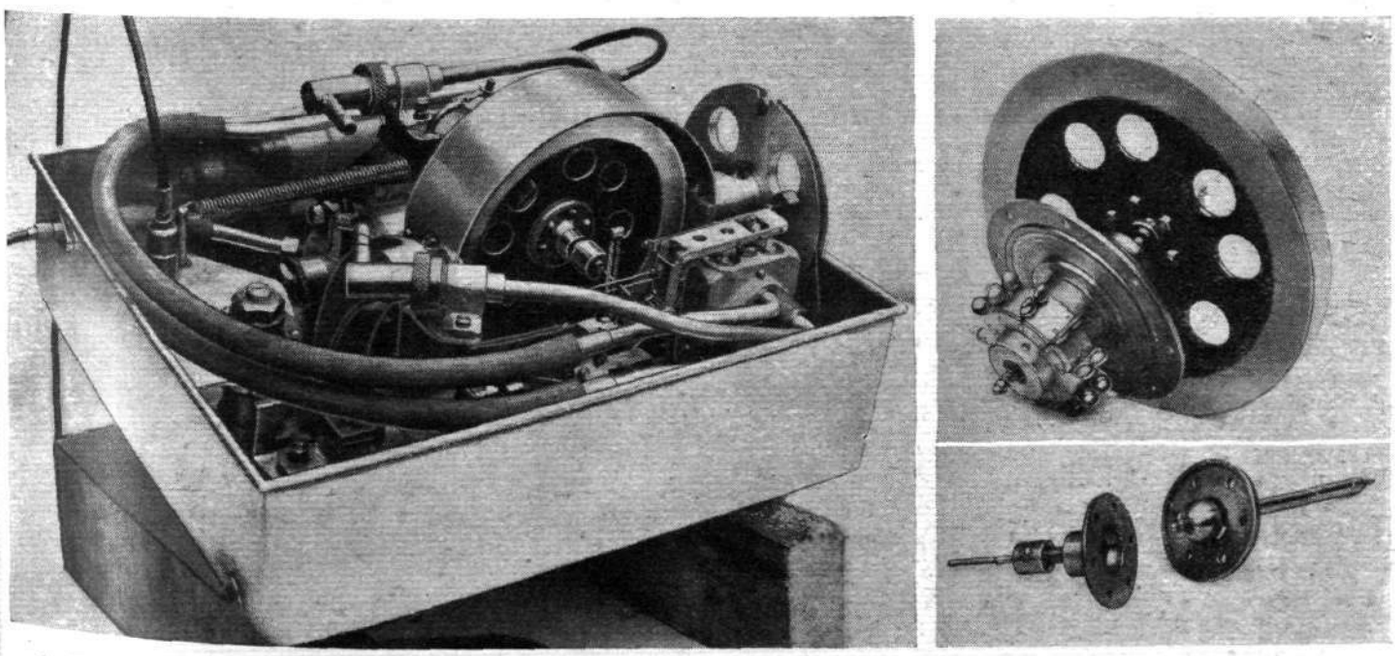
The complete gyro unit is mounted on a cradle which also carries the servo operating valves, the mechanism of which includes double forks engaging an extension of the gyro wheel spindle. In the case of the rudder and elevator controls there are two sets of valves with forks at right-angles and the cradle is mounted universally on the main base plate, which also carries the servo cylinders and their lever systems.



This diagram shows the oil-pressure system and the general installation of the three-axes P.B. automatic control.

Any displacement with the gyro spindle causes a relative movement of the valves through their fork mechanisms, distributing oil pressure to their respective servo cylinders, whose pistons then actuate levers which in turn operate the respective aircraft controls, and each of which also returns its own respective part of the universal mounting so as to follow up the gyro wheel and centralise the whole mechanism.

The pilot is provided with two controls in connection with the mechanism. The first operates locking pins which connect the levers at the end of the servo pistons to the aircraft control mechanism, and the second centralises the gyro wheel



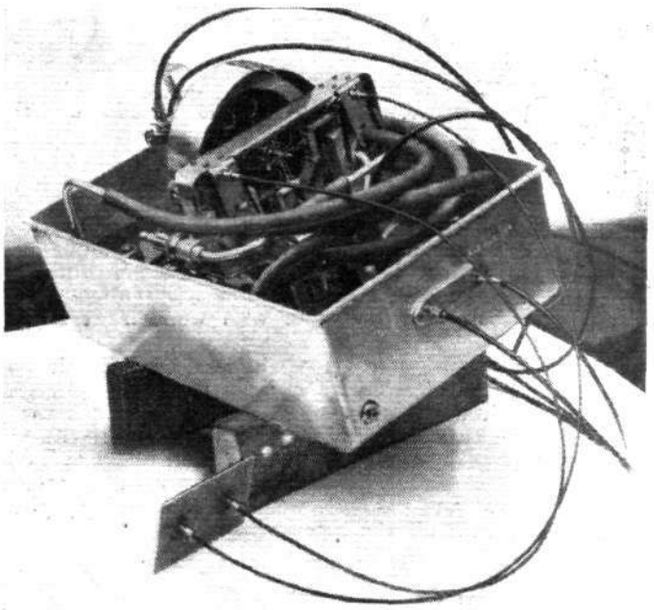
On the left is a general view of the apparatus for automatically controlling aileron movement. The extension of the rotor axis which engages with a fork operating the valves controlling the Servo pistons can be seen on the near side of the rotor wheel. On the right is the rotor, showing the Pelton wheel drive and the ball and cup suspension. (*Flight* photographs.)

on its drive and opens neutralising cocks to each end of the servo cylinders; this permits the pilot to over-ride the automatic pilot without actually disconnecting the mechanism. A fine adjustment is provided as a dashboard fitting. By means of flexible cables and small leaf springs it enables a bias pressure to be exerted on either pair of valves, so as to deflect the axes of the gyro wheel up or down, or laterally, and therefore, through the aircraft controls, to raise or lower the nose of the machine or deflect it to the right or left. This enables small adjustments to be made to the course of the aircraft, but for serious alterations or large and quick turns the over-riding mechanism should be brought into play, so that the pilot can control the machine regardless of the automatic pilot.

This, then, is the operation of the automatic pilot as applied to two axes. When required, a similar instrument, consisting of a gyro wheel with its axis running parallel to the wing spars of the aeroplane, can be fitted to control the aileron movements, and therefore to take charge of the machine laterally. Both the two- and three-axes types have been tested out in many kinds of aircraft, and from the short trial which *Flight* has been able to make, it would appear that the P.B. pilot certainly does its work admirably in both rough and smooth weather.

Mr. Philip Bailey, who does all the makers' test work, has made long flights from the Continent to this country in a "Puss Moth," and reports that the equipment's accuracy as regards course-keeping was all that could be desired, and that during some 400 hours' flying he has experienced no serious trouble at all.

In general, the P.B. automatic pilot is both reasonably small and light. The assembly for controlling the rudder and elevator is contained in an oil-tight case, the outside dimensions of which are 16½ in. by 9¾ in. by 10 in., and the weight is 28 lb. To this must be added 5 lb. for tank and pipes, 3 lb. for a small windmill pump (this oil-pressure pump can, if required, be operated from the engine), making 36 lb. in all, or with the oil, 42 lb.



A general view of the apparatus controlling the rudder and elevators. In this case there are two sets of valves, as the movement is in two planes. (*Flight* photograph.)

The apparatus for controlling the ailerons is slightly smaller, measuring 12½ in. by 9¾ in. by 7 in., and weighing approximately 18 lb.

FLYING-BOATS OF 134 TONS?

(*Continued from page 283*)

cludes the tail unit, lateral stabilisers, controls, internal hull structure, etc., probably amounts to about 13 per cent. of the total weight, bringing the total structure weight up to 40 per cent. If the reasonable assumption can be made that the weight of the power-unit installation would be approximately the same percentage of the all-up weight as for existing flying-boats, then this weight would represent about 17.3 per cent. of the total. For the design of boat we are considering this would result in the following weights:—

	lb.
Complete structure	120,000
Power Unit	52,000
Equipment, say	10,000
	182,000

leaving for fuel, paying load and crew an amount of 118,000 lb. For a boat of this weight it would probably be necessary to install engines developing a total horse-power of about 24,000 b.h.p. For continuous cruising about 16,000 b.h.p. could be employed, which would give a cruising speed of about 165 knots. With the present-day cruising consumption of 0.5 pints per b.h.p. hour the amount of fuel consumed per hour would be 1,000 gallons or roughly 8,000 lb. weight per hour. Assuming the paying load to be in the neighbourhood of 50,000 lb., then the range of the boat under these conditions would be about 1,600 statute miles.

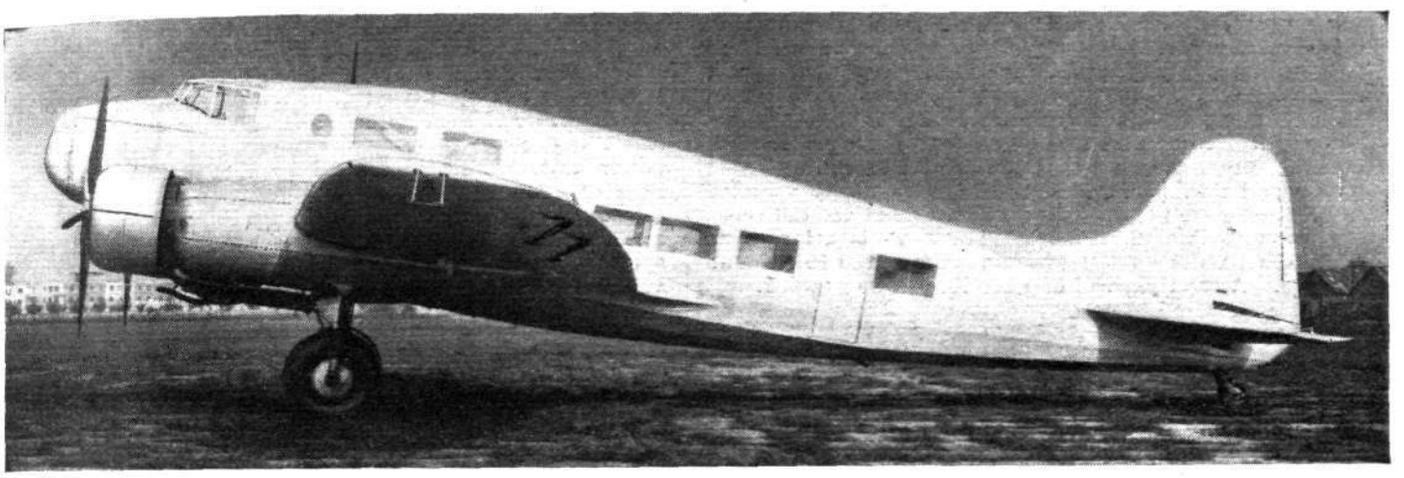
This particular example of what might be expected from future development is, of course, only my own personal views and is based on our present rate of progress. Of course, there is the possibility that with the advent of new methods of construction, improved materials and better aerodynamic knowledge we may improve on this—at any rate, sufficient to make regular crossings of the North Atlantic with a reasonable pay load. As far as I can foresee it will be at least a matter of ten years before we see regular Plymouth-New York crossings in a large flying-boat carrying passengers. This may seem unduly pessimistic taking into account the number of times the Atlantic has been crossed, but it must be borne in mind that all these flights have been carried out with machines loaded far beyond their normal Certificate of Airworthiness weight, and it is a far different proposition to run a regular service carrying passengers with a standard of comfort exceeding that now obtained on the London-Paris route.

However, the science of aeronautics is still in its infancy, and I think it only reasonable to assume that the development of the large aeroplane, and particularly the flying-boat, will attain a stage of perfection which has now been reached by the mercantile marine.

FOR AIR FRANCE. The Potez 62, a fourteen-passenger commercial adaptation of the maker's *multiplace de combat* type. Its two 900 h.p. "Mistral Major" two-row radials give a cruising speed of 175 m.p.h. The normal range is 625 miles and the ceiling 26,000 ft.

COMMERCIAL AVIATION

AIRLINES — AIRPORTS



. . . AND NOW ITALY : One of the latest machines built to the modern formula for transport machines—*i.e.*, two engines, cantilever wing and retractable undercarriage—is the Caproni 123. On 1,760 h.p., given by two Gnome Rhone K.14's, the machine cruises at 167 m.p.h.

CROYDON

Back to School : New Use for an "Argosy" : Tail-first to the Tarmac : A New "Instructor and Pupil" Story : The Gold Business

DURING most of last Friday, the coldest day for years, Capt. Rogers, of Imperial Airways, stood on the tarmac with the kindly but critical air of a father watching a small son learn to fairy-cycle. The new batch of probationary first officers were flying the old Westland "Wessex" under his eagle eye.

Capts. Horsey and Oliver were also busy last week putting the Boulton Paul *Boadicea* through her paces, and *Dorado*, piloted by Capt. O. P. Jones, went for her maiden special charter flight to Berne to pick up a stretcher case. A new "Diana" class machine, called *Delia*, was also delivered.

Considerable local excitement was caused by the night flight of an "Argosy" with "Air Mail" in huge neon letters on the lower wing. This form of advertising seems to be popular at present, and more than one machine is being fitted with such advertising signs. It is understood that the "Argosy" has the neon tubes mounted on rubber sponge shock absorbers, and that there are various secret methods of obtaining the best results—each individual method being far superior to all the others. Seen from a distance and at certain angles, a neon-lit machine causes short-sighted householders to ring up the Control Tower, or even the Fire Brigade, and announce that an aeroplane is in flames.

A short time ago a large commercial machine terminated its landing quite near to its own hangar, and for some reason, possibly a stalled engine, it was towed to the tarmac by tractor, complete with pilot, passengers, and ensign gallantly fluttering. The tractor being attached to the tail, the arrival was made backwards, to the amazement of the passengers' friends, who went away with an idea that tugs were used to bring aerial vessels into port.

A novel use of the aeroplane was made last Sunday when five members of a Croydon cycling club, with their machines, flew to Hatfield where they went for a run with the local club. The machine returned to Croydon with five Hatfield cyclists and their mounts, who were the guests of a local club, which showed them a favourite stretch of its territory. In the evening the same aeroplane made a return trip between Croydon and Hatfield, thus conveying both detachments of cyclists to their home towns.

Imperial Airways took a passenger on Sunday's African Air Mail who is going to a remote part of Africa in search of pigmy men and miniature elephants. He was connected, it is understood, with the recent importation of brass-ringed giraffe-necked belles. The question of importing the pigmies by air, if and when they are found, is still in abeyance. In an air liner they would look distinctly out of their element, even if attired specially for the occasion in bowler hats and lounge suits.

The old chestnut about the pupil who took up a spare joy-stick and threw it overboard to scare his instructor may be fiction, but last week it is a fact that an instructor of Surrey Flying Services took a pupil up, and, desiring to take over, groped for his joy-stick but found it missing. He continued to instruct quite calmly, ending with "now try a landing." The pupil did a creditable one, but received the shock of his life when his instructor went to the back locker and produced the joy-stick with the remark, "Just as well I should have one, too."

Speed and Advertising

One day last week a train averaged about 67 or 68 m.p.h. from King's Cross to Leeds. Once it touched the somewhat old-fashioned speed of 108 m.p.h. This was quite good going—for a train—but why did the B.B.C. give a detailed account of the whole business and valuable free advertising to the railway company, even telling the public the freight rates on milk and other goods? If this sort of advertising is to be the order of the day, some of the notable speed achievements of commercial air liners could be broadcast with advantage, and traffic managers would be glad to have the public know how little it costs to transport, say, a pound of truffles from Paris to London in very little longer time than it would take a chef to prepare an intricate sauce for them.

The excitement about the missing bullion died down at Croydon towards the end of the week. The place had been infested with hawk-eyed crime reporters looking like Scotland Yard men and by other people, looking like small farmers and chartered accountants, who really were from Scotland Yard. Photographs in the Press of detectives examining the burgled safe turned out to be pictures of well-known members of the Croydon staff peering in short-sighted rapture at an unidentifiable door knob.

Several people of a humorous turn of mind nearly got themselves arrested by producing real sovereigns in the buffet, or by asking, in a hoarse but penetrating whisper, in the hearing of the sleuths, how lawn turf, recently disturbed, could be replaced so as to leave no trace.

A. VIATOR

Commercial Aviation

AN INTERESTING REVIVAL

New Burnelli with Tapered Wings under Construction : 225 m.p.h. with two 725 h.p. Wright "Cyclones"

THE first large Burnelli aircraft embodying a fuselage of aerofoil section was produced as long ago as 1920. Since that date various developments of the original model have been constructed, but have never been produced in large numbers. Now the Uppercu-Burnelli Aircraft Corporation, of Keyport, New Jersey, U.S.A., which was formed in 1930, is building the Burnelli type 101 high-speed transport monoplane.

While retaining the characteristic Burnelli fuselage of aerofoil shape, it incorporates several modern refinements. The high, externally braced monoplane wing is tapered both in plan form and thickness, and embodies hydraulically operated flaps. Not only are the main landing wheels but the tail wheel also is retracted into the fuselage. The cabin is arranged to seat fourteen passengers and to accommodate 800 lb. of mail or baggage. A total payload of 3,200 lb. can be handled.

Structurally, the fuselage embodies flat stressed duralumin skin over a framework of extruded duralumin sections, with fittings, engine mountings and undercarriage of heat-treated chrome molybdenum steel. The two Wright "Cyclone" nine-cylinder radials, giving 725 h.p. at 7,000 ft., are enclosed in N.A.C.A. cowlings and mounted on the leading edge of the central structure. Oil and fuel are carried within the wing. It is claimed that, as a result of the proximity of the engines to the centre line of the aircraft, there is a high degree of single engine effectiveness in the event of the failure of one power unit. This is increased by the fact that the thrust lines of each power plant are directed slightly inwards.

The weight empty is given as 8,000 lb. and the gross weight as 14,000 lb. Estimated performance figures show a maximum speed of 210 m.p.h. at sea level, and 225 m.p.h. at 10,000 ft. With full load the machine should land at 63 m.p.h.

Shadow-bar for Cardiff

During the coming month the shadow-bar system of flood lighting will be installed at Cardiff airport, and the aerodrome is also to be extended. Meanwhile an aerodrome hotel is a future possibility.

The "Electra" in Canada

Fairchild Aircraft, Ltd., of Longueuil, Montreal, has secured the design and manufacturing rights of the Lockheed "Electra." This machine, which is normally equipped with two P. and W. "Wasp Juniors" of 400 h.p. each, carries ten passengers at a cruising speed of 195 m.p.h. at 11,400 ft. The "Electra" is in service in the U.S., Alaska, Mexico and Cuba.

A Shetland Service?

Provided that radio stations are arranged, Capt. E. E. Fresson, of Highland Airways, Ltd., may extend the Orkney service to Shetland this spring. At the time of writing the matter appeared to be in the hands of the Shetland County Council, which had been asked to pay one-tenth of the maintenance costs of a mobile radio station. The Air Ministry has already expressed its willingness to establish such stations at Inverness, Kirkwall and Sumburgh (Shetland) so long as the local authorities will give this small financial support. Highland Airways' machines are being fitted with radio.

Developments at Essex Airport

During this season Hillman's Airways will be running three daily services to Paris, and before the middle of the summer the company will have three D.H.86 (four "Gipsy Six" engines) machines in service. The first of these is to have full dual control for training purposes, but the second and third will be fitted with the swing-over type of column. Apart from Marconi sets and blind flying instruments, these D.H.86s will have "homing" equipment. At the moment, as recorded in *Flight* of February 28, Hillman's are waiting for permission to use their own D/F station and to operate a short-range transmitting set.

Essex Airport will presently be equipped with complete night landing and boundary lighting. Experiments are proceeding with the new boundary lights developed by the Cardiff Foundry and Engineering Co., Ltd., which not only indicate the perimeter of the aerodrome in an unmistakable manner but also give the incoming pilot a very fair idea of his own vertical position in relation to the boundary over which he is due to pass, and it appears likely that these will be used throughout. Capt. T. N. Stack, who, incidentally, has been working more or less twelve hours a day in his position as manager, and whose influence is already more than noticeable, is distinctly impressed by them.

A little mental arithmetic shows that, with their new D.H.86s, Hillman's will have a service fleet of a dozen machines, apart from the "Fox Moth" and "Puss Moth" used for charter. Last week they took delivery of two more "Rapides," but two of the three previously owned are temporarily out of action. One was blown over on to its back in the Isle of Man, and the other was slightly damaged in a fog landing at Speke. Another large hangar is to be erected to house the new members of the family.

To the Isle of Wight

Spartan Air Lines, Ltd., have just published their spring time-table. During March there will be two services every day each way from Croydon to Bembridge and Cowes. The summer time-table will be used after April 13, and the fares are 26s. 6d. single and 45s. return.

South African Agreement

The long-expected agreement between South African Airways and South-West African Airways appears now to have been arranged. A proposal has been made by Mr. Pirow, Minister of Railways, that S.A. Airways should purchase the S.W.A.A. fleet and equipment and operate the present subsidised air mail service from Windhoek to Kimberley. They will also open a service between Cape Town and Windhoek.

Speke Extensions

The new hangar at Speke—the first of two which are to be erected—will have two doorways and a clear space measuring 325 by 150 ft. It will be about nine times the size of the existing hangar. Attached will be a garage, workrooms and a large workshop. The control tower is to be seventy feet high and should be completed in about two months. Plans for the main administration building are now in preparation.

Another Internal Airline

On or about April 1 a new company, North-Eastern Airways, Ltd., will be opening a daily service between London and Edinburgh, using Airspeed "Envoys" These machines cruise at about 150 m.p.h., and the whole journey, including stops, will be made in 2¾ hours.

According to the preliminary time-table there will be two services each way between Newcastle-on-Tyne and London, and one each way between Edinburgh and London. An "Envoy" will leave Newcastle (Cramlington) at 8.30 a.m., Leeds (presumably Yeadon) at 9.15, and will arrive at Heston at 10.25. This machine will leave again at 4.15 p.m., and will reach Newcastle at 6.10. Another will leave Heston at 10 a.m., reaching Leeds at 11.10, Newcastle at 11.55, and Edinburgh at 12.45. This will start on the return journey at 2.35, and will be at Heston at 5.20 after calling, as before, at Newcastle and Leeds. The fares will be £10 return over the whole distance, £7 1s. return between London and Newcastle, and £4 13s. return between London and Leeds.

As there is no suitable commercial aerodrome near Edinburgh, permission has been applied for to use the R.A.F. aerodrome at Turnhouse. Ground transport at all centres will be included in the fares, and coaches or cars will leave the town centres forty to fifty minutes before the scheduled departure of the machines.

The "Envoys" will be equipped with wireless, though none of the aerodromes on the route have radio stations at present. Heston should have D/F this year, and it is possible that the new airport at Woolsington, for Newcastle, which will be ready during this year, will also have the necessary equipment in due course, and if services demand it. For the moment, the North-Eastern Airways pilots will be able to keep in touch with Manchester and Croydon.

CZECHOSLOVAKIAN: Carrying from fourteen to sixteen passengers, the Aria 57, with three 575 h.p. radials of "Cyclone" type, cruises at 180 m.p.h. Dr. Robert J. Nebesar, the designer of the machine, tells us he is quite satisfied with the results of test flights.

Another Junkers for South Africa

A fourth Junkers Ju 52 (three B.M.W. "Hornets") will shortly be leaving for South Africa, where it will be put in South African Airways service.

Norwich Goes Ahead

With the idea of encouraging people to use the main air lines and of showing operators something of the traffic potentialities of Norwich, the Norfolk and Norwich Club has purchased a machine suitable for taxi and charter work. The machine will be used by the club as a high-speed link with the airline centres of the country until such a time as the air services reach Norwich.

Seadromes on the Pacific

It is possible that several small Seadromes, for meteorological and radio services, will be moored in the Pacific preparatory to starting the Pan-American service to China. The construction of these bases, at a moderate cost, will settle for all time the doubts that have been expressed concerning the performance of the Seadrome under bad conditions. Meanwhile, it is understood, certain Pacific islands are to be used for the same purpose, and the company's supply ship, *Northhaven*, will leave San Francisco shortly with all the materials and technical experts. Five islands have been selected—Hawaii, Midway, Wake, Guam and Manila.

Progress at Penshurst

Working continuously at full capacity has been the order of the winter at Penshurst. Since the end of last summer there has scarcely been a vacant square foot in the repair shops, and Air Travel, Ltd., has occasionally been compelled to refuse work.

On March 1, in addition to miscellaneous jobs, work was in hand on fifteen aircraft and twenty-six engines.

Incidentally, the Penshurst staff of twenty-five probably contains a higher percentage of skilled men than any other in the industry—no less than nine ground engineers being employed, apart from other specialists.

Night Landings at Gravesend

Both K.L.M. and Deutsche Luft Hansa are to use Gravesend airport as an alternative landing ground. The first company will be running a late service to London after April 1 and "flare path practice" is now being carried out at Gravesend under the direction of Mr. Spencer, the manager, and of a K.L.M. representative. There are times, of course, when Croydon is impossible, and Gravesend is on the route taken by all machines from Schiphol (Amsterdam) and Berlin.

For the present, hurricane lamps are used for boundary marking, paraffin flares for landing, and a searchlight (made by the airport staff!) for signalling and guiding purposes, but in due course the airport will be electrically lit throughout. A night landing "Tee" will be in service at the end of this month. Gravesend is an ideal aerodrome for night operations as the buildings are sensibly grouped in one spot on the eastern boundary, and there are no obstructions worth the name on any other side. The N.E. by S.W. run is something like 1,200 yards, and the Kent side of the Thames, in any case, is peculiarly free from fog.

D/F at Brindisi

The Italian authorities, it is understood, are to provide new wireless and D/F equipment for Brindisi.

Brighton's Airport

Work on the Brighton, Hove and Worthing airport—across the road from the present Shoreham aerodrome used by the Southern Club—is going ahead rapidly. The hangar frames have been erected and the site itself has been levelled. B.A.N. Co., it will be remembered, are to be the first tenants, and the aerodrome will be a valuable halt on their Continental services, near as it is to such a famous trio of coastal resorts. Mr. Jackaman's company, London and Continental Air Lines, may also use it on their fast Paris service.

Blind Flying for "B" Licences

The following civil training schools have so far been provisionally approved by the Air Ministry for the purpose of providing courses in blind flying.

(1) Airports, Ltd., Gravesend and Gatwick. (2) Air Service Training, Ltd., Hamble. (3) Airwork, Ltd., Heston. (4) Aircraft Exchange and Mart, Ltd. (London Air Park Flying Club Ltd.), Hanworth. (5) Bristol Aeroplane Co., Ltd., Filton. (6) Brooklands Aviation, Ltd., Byfleet. (7) British Air Transport, Ltd. (Redhill Flying Club), Redhill. (8) The Cotswold Aero Club, Ltd., Gloucester. (9) The Hampshire Aeroplane Club, Southampton. (10) The Lancashire Aero Club, Woodford. (11) The London Aeroplane Club, Hatfield. (12) The Midland Aero Club, Castle Bromwich. (13) The Newcastle-on-Tyne Aero Club, Cramlington. (14) The Northampton Aero Club, Sywell. (15) North Sea Aerial and General Transport, Ltd., Brough. (16) Surrey Flying Services, Ltd., Croydon.

Empire Mails

The Federal Cabinet has approved the air mail scheme, subject to the arrival of full information. At the Conference the Commonwealth representatives were, generally speaking, in favour of the whole scheme as outlined by the British Government, but were distinctly worried by the question of finance. It appears that the proposal to use flying-boats over the whole Singapore-Sydney route has been abandoned, and that Australia's right to impose her own surcharge, if necessary, has been admitted. Incidentally, the D.H.86s are now in full use over the Qantas section of the route to Australia.

Sir Frederick Williamson is now in New Zealand, and will shortly visit Canada to discuss plans for a Transatlantic mail.

Sir Eric Geddes, speaking at the Press Club on March 8, said: "With the help of the Post Office and the Air Ministry we shall be able, with a very much less proportional subsidy, to carry the whole of the air mail to the whole of the Empire—and at normal rates.

"When this new air scheme now before the Empire Government is developed and accepted by them, the percentage of subsidy to earned revenue will drop by about 50 per cent.

"The Secretary of State has told you that in his plans, which embrace our plans, he looks to air connections to Hong Kong and later to New Zealand and Canada. We have already arrangements in train in Newfoundland for the arrival in a year or two's time of a Transatlantic mail service."

ON the BOOKSHELF

Capt. Olley Tells His Story : Cavalcade of 1908-1914 : A Valuable Reference Book

A Commercial Pilot's Life

"A Million Miles in the Air." By Captain Gordon P. Olley. (Hodder and Stoughton, Ltd., 7s. 6d.)

WE have had many books describing flights across deserts and oceans, and we have also had many books describing the work of airmen in the war. Capt. Olley is the first man of world-wide reputation who has told the story of a commercial pilot. Olley, of course, had his war experiences. He was in turn both a mechanic and a pilot with No. 1 Squadron in France, but he hurries over that part of his career and gets on speedily to the post-war spread of commercial flying.

In that movement he has played an outstanding part. Of all the notable pilots who have helped to build up the reputation of British air liners, none has had a greater reputation than Olley for caution, reliability, and consideration for passengers.

The task of flying regularly to and fro between two cities has seemed irksome and monotonous to some pilots—C. W. A. Scott, for example, admits that he found it so. Olley, on the contrary, gives no hint of boredom. It evidently fascinated him to see the present wonderful organisation growing up and gradually taking form out of very crude beginnings. He sensed the romance in "the daily round, the common task." He does not quote Kipling's:

"Romance!" the season-tickets mourn,
He never ran to catch his train,
But passed with coach and guard and horn—
And left the local—late again.
Confound Romance! . . . And all unseen
Romance brought up the nine-fifteen.

His whole book, however, breathes the spirit of those lines. If, however, regular mail work had ever wearied Olley's spirit, he got plenty of change from it. For years he did special charter work for Imperial Airways before he started his own company, and when air taxis are the order of the day Romance does not work unseen. Olley has some curious experiences to relate, the most remarkable being when he was director of aviation to the late Capt. Alfred Lowenstein, who was afterwards killed by falling from an aeroplane over the Channel. That was a really hectic time, and Olley gives an excellent picture of the hustling life of a millionaire financier.

Olley's book is well written and moderately illustrated (the most interesting picture is one of lions eating a dead zebra), the contents are fascinating, and the price is moderate. It deserves a place in every aeronautical library.

F. A. DE V. R.

History in the Making

"The History of British Aviation, 1908-1914," by R. Dallas Brett. (John Hamilton, Ltd., 21s.)

IT is now possible to give a somewhat more detailed review of Mr. Dallas Brett's contribution to aeronautical bibliography, published some little time back. In the 380-odd pages of this book he has packed an amazingly large number of facts, very painstakingly arranged in chronological order and each awarded its fitting share of importance.

Though the casual reader who knows nothing of those early days and the pilots who lived (and died) in them may not find this book so gripping as an autobiography, it has plenty of digressions into anecdotes, eye-witness accounts, and so forth, which remove it far from the dry-as-dust history book class. For instance there is a long description, in the pilot's own words, of Sydney Pickles' crash at Hendon on the Champel pusher biplane in 1913, when he carried Mrs. Stocks as passenger; seldom can the second-by-second sensations of such an extremely unpleasant experience have been so accurately described and some rash young men of to-day might well profit from a perusal of the story.

But it is as a work of reference that *The History of British Aviation* has its chief value. It is extremely well indexed, both chronologically and alphabetically, so that any desired information can be unearthed at once, and there are appendices setting out records, results of races, lists of pilots qualifying for certificates at home and abroad, and so on.

Lastly, the book's value in this direction is greatly enhanced by the completeness of the illustrations, practically all of which are *Flight* photographs and diagrams, numbering sixty-four of the former, and sixteen of the latter.

For Reference

"Jane's All the World's Aircraft," 1934. Compiled and Edited by C. G. Grey and Leonard Bridgman. (Sampson Low, Marston and Co., Ltd., London. 42s. net.)

JANE'S All the World's Aircraft is fast becoming an essential standard work of reference, comparable with *Webster, Debrett's Peerage, Who's Who* and *Bradshaw!* The last volume of *Jane's* (the twenty-fourth edition), for the year 1934, apart from its utility as a reference for data concerning last year's aircraft, engines, and airships, makes really interesting study, especially on the score of what the various countries are doing in the matter of service and commercial development.

It is as well produced as ever—if not better—and is divided, as usual into four parts—A and B, World's Aeronautical Progress; Historical, Civil and Service; C, Aeroplanes; D, Engines; E, Airships. A short list of the world's great flights and records is also included. The illustrations—mainly photographs, general arrangement drawings are not so numerous as previously—are excellent, and the data, in nearly every case, are remarkably complete. We have only one criticism to make—and that is, we miss the index to names and types of aircraft, a very useful feature introduced a few years back.

PUBLICATIONS RECEIVED

Stratosphere and Rocket Flight. (Astronautics.) By C. G. Philp. Price 3/6 net. London: Sir Isaac Pitman & Sons, Ltd.

How to Find Your Way in the Air. By G. W. Ferguson. Price 3/6 net. London: Sir Isaac Pitman & Sons, Ltd.

VDI Zeitschrift des Vereines Deutschir Ingénieure. Technische Messe, Leipzig, 1935. Germany: VDI-Verlag G.m.b.H., Berlin, NW.7.

The Romance of Flight. By Norman MacMillan. Price 2/- net. London: Evans Brothers, Ltd., Montague House, Russell Square, W.C.1.

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NEW COMPANIES

YAPTON AERO CLUB, LTD., Ford Aerodrome, Yapton, Sussex. Capital £1,000 in £1 shares. Objects: to acquire the business of a light aeroplane club carried on by Flt. Lt. Allen L. R. Duke and Mary J. Duke at Yapton, Sussex, and to carry on the business of a flying and aeroplane club, etc. The first directors are: Allen L. R. Duke, and Mrs. Mary J. Duke, Yapton Aero Club, Ford Aerodrome, Yapton, Sussex. Secretary: Mrs. Mary J. Duke. Solicitors: Thomas W. Cuns, 50, High St., Bognor Regis.

B.A.C. (1935) LTD., Victoria Road, Feltham, Mddx. Capital £1,000 in 1/- shares. Objects: To carry on the business of designers, constructors and operators of all types of land and marine aircraft, motor vehicles, motor boats and marine engines, etc. The first directors are:—Robert Kronfeld, 119, Piccadilly, W.1 (technical director of Société Française d'Aviation Nouvelle), and James Lowe, 17, Alfred Rd., Feltham, Mddx. Secretary: James Lowe.

ROLLASON AIRCRAFT SERVICES, LTD., Airport of London, Croydon, Surrey. Capital £10,000 in 8,000 shares of £1 each and 40,000 shares of 1/- each. Objects: to acquire the business of Capt. Wm. A. Rollason and Fredk. A. Kent at Airport of London, Croydon, as "Rollason Aircraft Services," and to carry on the business of dealers in aircraft and other vehicles, engines, accessories, spare parts and tools, etc. The permanent directors are:—Capt. Wm. A. Rollason, Chelsworth, Buckingham Way, Wallington, Surrey, and Fredk. A. Kent, 68, Stanley Park Road, Wallington, Surrey.

NORTH-EASTERN AIRWAYS LTD. Nominal capital, £20,000 in £1 shares. The objects are to inaugurate, construct or control, maintain and work air-services in any parts of the world, and any land, sea or other services which may usefully be run either in connection with or as distinct from such air-services, etc. The directors are:—Lord Grimthorpe, Easthorpe Hall, Malton (chairman of Airspeed (1934) Ltd.); Robert H. S. Fitzroy de Vere Somerset, Ince Castle, Saltash, Cornwall, managing director, and Alfred E. Hewitt, 3, St. Leonards, Yorks., solicitor. Solicitors: Alfred E. Hewitt, 3, St. Leonards, York.

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INCREASES OF CAPITAL

PROVINCIAL AIRWAYS, LTD. (Airport of London, Croydon). The nominal capital has been increased by the addition of £20,000 beyond the registered capital of £10,000. The additional capital is divided into 15,000 participating preference shares of £1 each and 20,000 ordinary shares of 5/-.

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AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations: Cyl. = cylinder; i.c. = internal combustion; m = motors.
(The numbers in parentheses are those under which the specification will be printed and abridged, etc.)

APPLIED FOR IN 1933

Published March 14, 1935.

22309. BOYSSON, J. B. A. De. Universal supporting means for mounting kinematographic cameras or other apparatus on aircraft. (424,002.)
23030. VICKERS-ARMSTRONG, LTD., and SWIFT, T. R. Aircraft bombs. (424,002.)
23240. JONES, T. Aircraft of the gyroplane type. (424,140.)

APPLIED FOR IN 1934

11327. CONSTABLE, A. F. Mental reaction testing-apparatus, particularly applicable to testing potential flying ability. (424,037.)

FLIGHT

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MISCELLANEOUS ADVERTISEMENTS

Aircraft and Engines For Sale

HERMES METAL AVIAN, C. of A. August. Dual instruments including compasses. Navigation lights. Low and high pressure wheels. All modifications. Perfect condition: £275. HERMES II ENGINE: hours since complete, 245; hours since top, none. All new pistons: £40. Box No. 8732, c/o "Flight," Dorset House, Stamford Street, London, S.E.1.

FOR Sale. 40 h.p. Salmson Klemm, cruises 70, C. of A. November, 30 hrs. since top overhaul and C. of A. £225. R. Somerset, North Eastern Airways, Heston.

BRISTOL Fighter 3-seater, Rolls-Royce engine. £25, or exchange car. Also Avro N. fuselage, 4 main planes and tail planes, £3. Willesden Aircraft, 437a, High Road, Willesden, London. 'Phone: Willesden 5619.

Aircraft and Engines Wanted

WANTED to purchase, aircraft, all types, age or condition immaterial, from £20. Also engines from £5. Box No. 1015, c/o "Flight," Dorset House, Stamford Street, London, S.E.1.

Patent and Trade Mark Agents

STANLEY, POPPLEWELL & FRANCIS, Chartered Patent Agents, 88-90, Chancery Lane, London, W.C.2. Telephone: Holborn 6393. Established 1879.

A. P. THURSTON & CO., Chartered Patent Agents, 329, High Holborn, W.C.1. Tel.: Hol. 1117.

F. J. CLEVELAND & CO., Chartered Patent Agents, 29, Southampton Buildings, London, W.C.2. Telephone: Holborn 5875-6.

GEE & CO. Patents and Trade Marks throughout the World. (H.T.P. Gee, Mem. R.S.G.B., A.M.I.R.E., etc.), 51-52, Chancery Lane, London, W.C.2 (2 doors from Govt. Patent Office). 'Phone: Holborn 1525. Handbook free.

KING'S Patent Agency Ltd. (B. T. King, C.I.M.E., Registered Patent Agents, G.B. U.S.A., and Canada). Advice, Handbook and Consultations free. 49 years' references. 146a, Queen Victoria Street, E.C.4. 'Phone: City 6161.

Contractors for Aerodromes

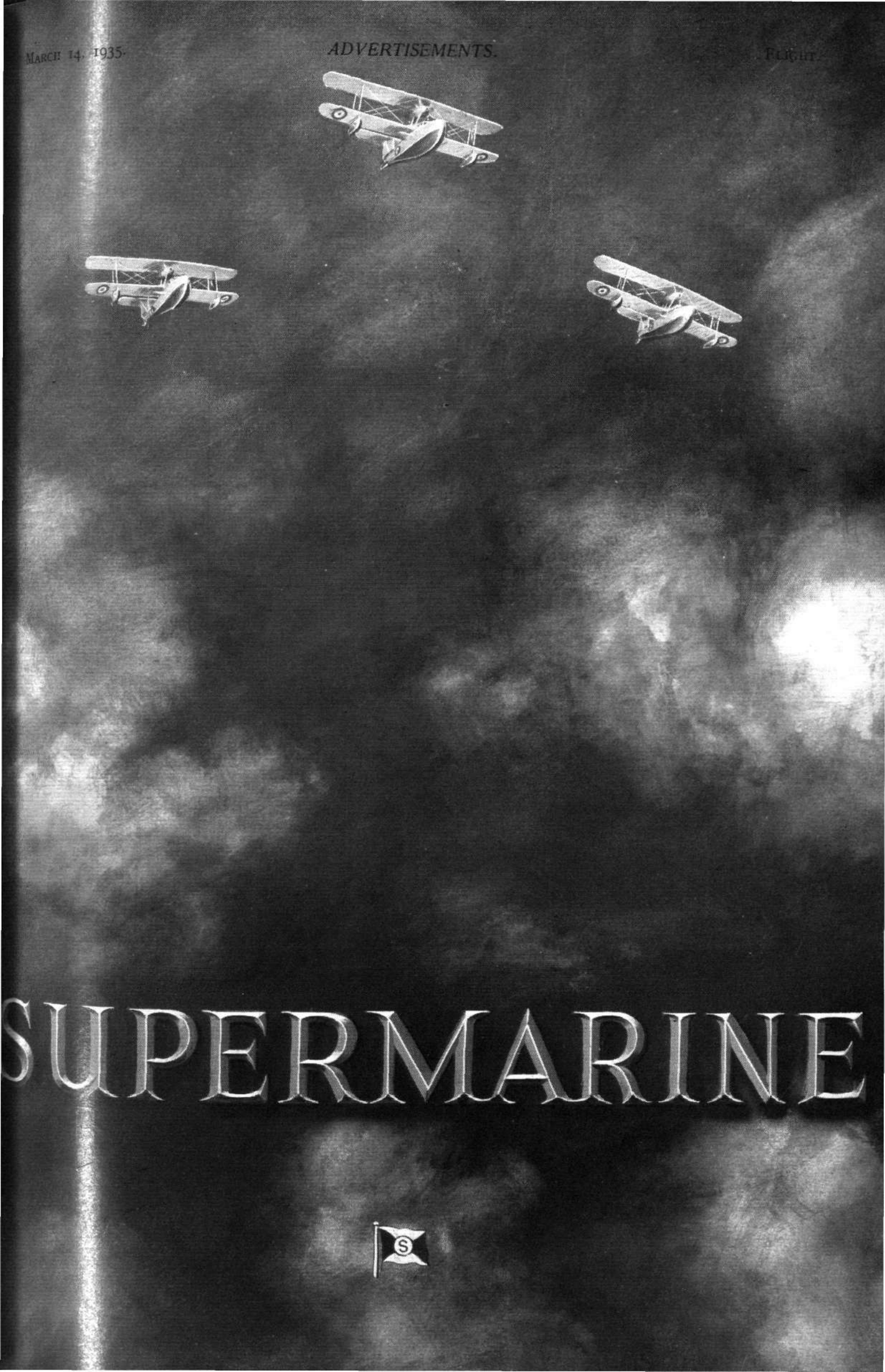
P.C.S. LTD. Painting Contractors and Decorators, Structural alterations, Heating and Sanitary Engineering, 74, Victoria Street, S.W.1. (Victoria 1031.)

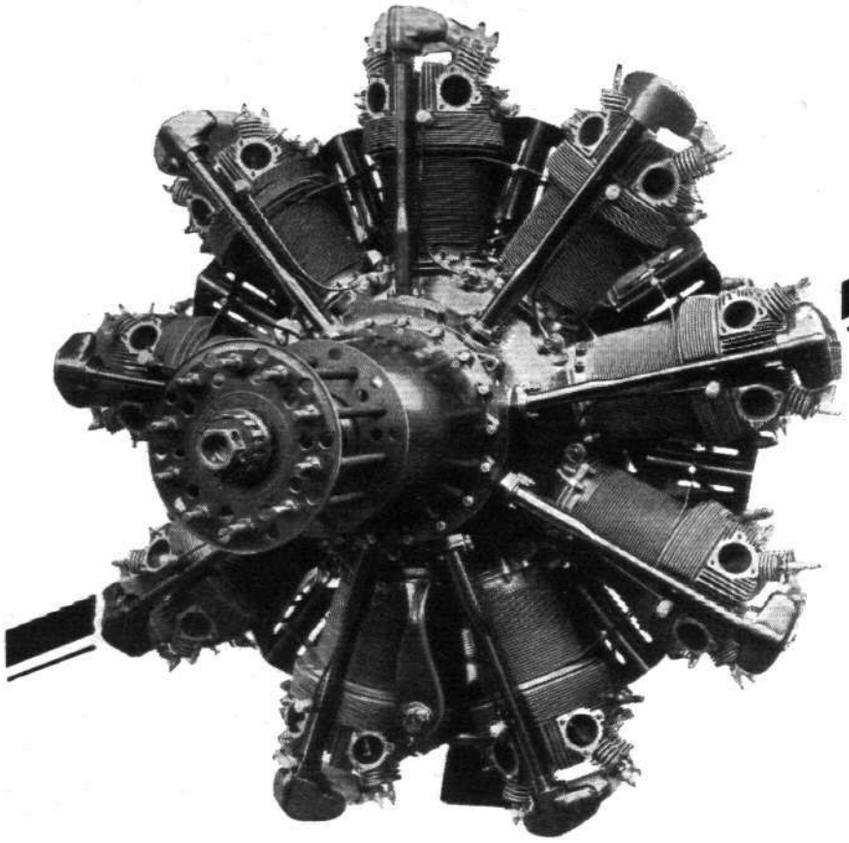
OVERHEAD LIMITED. Electrical Engineering and Public Works Contractors. Ground Lighting, Cable Laying, Power and Installations, Aerodromes and Factories.—74, Victoria Street, S.W.1. (Victoria 1031.)

DEMOLITION & CONSTRUCTION CO., LTD. Civil Engineering, Building and Public Works Contractors—74, Victoria Street, S.W.1. (Victoria 1031.) Contractors to Messrs. De Havilland Aircraft Co., Hatfield.

Miscellaneous

AEROPLANE Wheels, complete with tyres, tubes, axles, etc., from 30s. pair. Aircraft Stores, Primrose Garage, Radlett Road, Watford, Herts.


SUPERMARINE



"Bristol"

PEGASUS III
AIRCOOLED ENGINE

is designed to operate on the service fuel of 87 minimum octane value and has an exceptionally attractive power output for take-off and climb. Although the supercharger is of the medium speed type and maintains normal pressure in the induction system up to 4,750 ft. at maximum r.p.m., full throttle power is available for take-off and climb. In view of these characteristics, this engine is suitable for a wide range of aircraft covering general service types, marine aircraft and certain civil machines where a good performance at altitude is necessary.

PEGASUS III ENGINE.

The standard reduction gear for this engine is 0.5, but alternative ratios of 0.572 and 0.444 are available if desired.

PERFORMANCE DATA.

Normal Engine r.p.m.... ...	2,200
Maximum Engine r.p.m. ...	2,525
B.H.P. for take-off at Sea Level at normal r.p.m.	750/775
Rated Output at normal r.p.m.	665/690 at 3,500 feet
B.H.P. at maximum r.p.m. ...	725/750 at 4,750 feet
Fuel Specification	D.T.D. 230
Minimum octane value ...	87

Designed and Manufactured by
THE BRISTOL AEROPLANE CO., LTD.,
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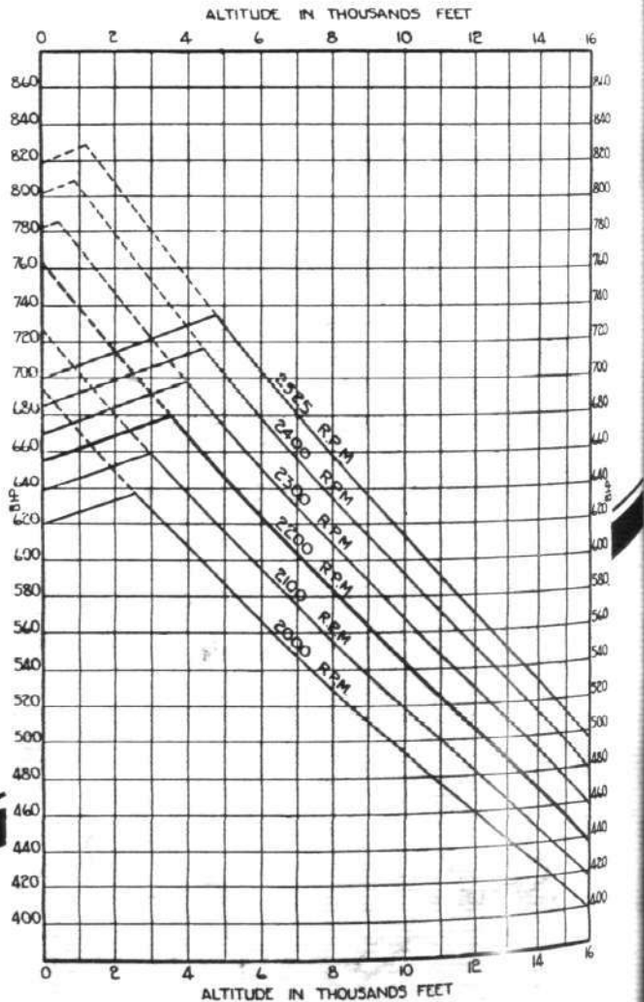
Telegrams: "Aviation, Bristol."
Telephone: Bristol 45051



PEGASUS III.
POWER AT ALTITUDE.

STANDARD TEMPERATURE & PRESSURE CONDITIONS. FUEL 87 OCTANE.
- - - - - - POWER AVAILABLE FOR TAKE OFF AND CLIMB
——— POWER AVAILABLE WHEN RATED BOOST IS NOT EXCEEDED

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